Essays on immigration policy

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Contents

List of Figures

List of Tables

Acronyms

BLS	U.S. Bureau of Labor Statistics
CMO	Mexican Classification of Occupations
DHS, USDHS	U.S. Department of Homeland Security
ENADID	National Survey of Population Dynamics
INEGI	National Institute of Statistics and Geography
INA	Immigration and Nationality Act
IRCA	Immigration Reform and Control Act
LAMP	Latin American Migration Project
LPR	Lawful Permanent Residence
MMP	Mexican Migration Project
MMP161	Mexican Migration Project database as of June 2017
MPH	Mixed Proportional Hazard
NAFTA	North American Free Trade Agreement
OES	Occupational Employment Statistics
Pew	Pew Research Center
SIPP	Survey of Income and Program Participation
SOC	Standard Occupational Classification
USC	United States Code
USCIS	U.S. Citizenship and Immigration Services

Chapter 1

Introduction

This PhD dissertation consists of three chapters in immigration economics. The main objective of the thesis is to explore how legal and unauthorized immigration systems interact and explore some of its consequences based on the case of the United States. Chapter 2 studies the U.S. immigration reform of 1986 and how it affected the migration dynamics of Mexican immigrants. Chapter 3 investigates the effect of documentation on immigrants' labor market outcomes. Chapter 4 studies the connection between a selective legal immigration system and the prevention of unauthorized immigration.

In all three chapters, time has been a central element. Chapter 2 studies the behavior of immigrants before and during their first trip and how it is affected by an immigration reform. The subsequent two chapters are based on events that happen between migration and return. In particular, both of Chapter 3 and Chapter 4 are based on the labor market outcomes of immigrants on their trip to the US, whether the trip is the first for an immigrant or not.

Amnesty has been one of the principal means for undocumented immigrants to obtain legal status. Recently, the U.S. policy-makers have been weighting the arguments for and against an amnesty with the proposals for the DREAM Act and the Border Security, Economic Opportunity, and Immigration Modernization

Act, which aimed to legalize a significant proportion of undocumented immigrants.

The Immigration Reform and Control Act (IRCA) of 1986 was the first legislative reform aimed at tackling the growth of unauthorized immigrants. It intended to control and deter illegal immigration to the U.S. through legalization of unauthorized immigrants, increased border security, and sanctions on employers that hired unauthorized immigrants. The law gave legal status to about 2.7 million unauthorized immigrants in the years following its enactment (Baker, 2010). Despite the IRCA, the number of illegal migrants residing in the US continued to grow from 3.5 million in 1990 to more than 11 million in 2015.

Chapter 2 investigates how the IRCA affected the migration dynamics of male Mexican immigrants focusing on their age of onset of migration and the duration of their first trip. A survey dataset of Mexican immigrants collected by the Mexican Migration Project was used for this analysis. The study finds that the IRCA delayed (the age of) Mexican men's first undocumented trip to the U.S., but did not have a significant effect on the return rate from their first undocumented trip.

This dissertation informs us about two important, interrelated topics in immigration research - return migration and the labor market performance of immigrants. Chapter 3 links these two topics. It analyzes the effect of having legal immigrant status on immigrants' occupational standing, job mobility and hourly wages in the U.S. For this analysis, I use a panel data consisting of lifetime histories of immigrant household heads in the MMP dataset. The results show that legal status leads to better occupational outcomes, wages, and job mobility. The study indicates that, by a conservative estimate, about 4-6 percentage points of the wage premium for legal immigrants can be explained by differences in occupational standing. This "occupational premium" is the average effect since the IRCA. It is estimated that the effect has been increasing in recent years. Overall, unauthorized immigrants experience a wage penalty of around 20 percent. Legal status also leads to higher job mobility in immigrants, although the effect is highest in the years immediately following legalization.

An important finding of this study is that immigrants' return behavior is affected

by their labor market outcomes in the U.S. I find that, although the differential effect on the return rate is small in size, larger gains in occupational standing is linked to lower rates of return. Thus, return and permanent migrants are differently affected by legal status. This has implications for measuring the effect of legal status on samples based on sending or accepting countries. In the case of this study, the estimated effect is likely to be a conservative estimate due to the oversampling of return migrants in the MMP survey.

Chapter 4 undertakes a theoretical analysis of the interaction between legal and unauthorized immigration policies. This paper contributes to the literature that focuses on the asymmetry of information between immigrants and their host country. It presents a model of immigration policy and immigrant behavior that highlights the trade-off between keeping out unauthorized immigrants and attracting highly skilled legal immigrants.

High-skilled individuals are in general offered more opportunities for legal immigration. Thus, it is the low-skilled immigrants who must frequently choose between legal and unauthorized immigration. They make a choice between the legal or unauthorized routes depending on the costs and benefits involved. The model predicts that, when enforcement against unauthorized immigration is increased, thereby raising its attendant costs, many low-skilled immigrants will attempt to enter legally. In short, policies on legal and unauthorized immigration affects the selection of legal immigrants by affecting potential immigrants' choices.

Empirical evidence is then presented to support the model. Using data from the Survey of Income and Program Participation (SIPP), we show that increased border enforcement is associated with a decline in the average quality of legal entrants. Legal immigrants' net monthly income earned in the U.S. are used to measure their productivity. Their productivity is then linked to the enforcement level at the time of their entry. A 1 percent increase in border enforcement is associated with a decrease in the income level of incoming legal immigrants of about 0.11 percent on average.

This final chapter of my dissertation shows that the policies on unauthorized and

legal immigration can be viewed as parts of a mechanism that makes up a selective immigration policy. When viewed as part of a coherent strategy, the policy on unauthorized immigration is a form of contract that can be used to improve the legal immigration outcome. As a form of contract, it can be further studied for its efficiency and usefulness, and its form can be improved to fit the overall goals of that policy. In particular, temporary legal migration options may be found to distinguish between types of immigrants while alleviating the harms caused by the unauthorized status on immigrants' labor market outcomes.

Chapter 2

U.S. Immigration Reform and the Migration Dynamics of Mexican Males[1]

2.1 Introduction

Immigration policies restrict the entrance of persons from other countries. There is a range of these policies from quotas that establish a maximum number of work and residence permits to be issued to foreigners to admission criteria that limit access (Boeri and van Ours, 2013). Admission criteria can be based on a point system in which individual-specific characteristics such as education, experience and language abilities are important. Admission criteria can also be based on family relationships or labor market conditions such as shortage of specific skills. During a large part of the twentieth century U.S. immigration was restricted through quota while over the last decades it was largely determined by family considerations, i.e. entry visas were assigned to those who had family members already in the U.S. (Daniels, 2002). The annual number of immigrants to the U.S. increased from a quarter of million in the 1950s to nearly half a million in the 1970s and

[1]Joint with Jan van Ours. Published in *De Economist* 165, 463–485.

close to a million in the 1990s. In the same time period, there was also big change in the source composition with a sharp rise in immigration from Asia and Mexico. In addition to the sharp rise of legal migration to the U.S. there was a big increase in unauthorized immigration, especially from Mexico (Clark et al., 2007).

The Immigration Reform and Control Act (IRCA) of 1986 was the first legislative reform aimed at tackling the growth of unauthorized immigrants. It intended to control and deter illegal immigration to the U.S. through legalization of unauthorized immigrants, increased border security, and sanctions on employers which hired unauthorized immigrants. The law gave a legal status to about 2.7 million unauthorized immigrants in the years following its enactment (Baker, 2010). Despite this effort, the number of illegal migrants residing in the U.S. continued to grow and stabilized at about 11 million since 2005 (Baker and Rytina, 2013; Passel and Cohn, 2016).

We evaluate the effects that the IRCA had on the migration dynamics of Mexican males. Changes in immigration law can affect the migrant stock in a country through several channels. A policy change may have an effect through both migrant inflow and outflow which in turn depend on the propensity to migrate to the country, the duration of stay, and the average number of trips each immigrant makes. Our study aims to investigate the overall effect of the IRCA on a Mexican-born individual. We distinguish between the effect on the propensity of taking a first unauthorized trip to the U.S. and the duration of the first stay in the U.S. In doing so, we attempt to separate the effects of the IRCA on the duration of stay of those migrants who are unauthorized throughout their stay from those who eventually receive legal status, as legalization limits the newly legal migrant's return behavior.[2] We compare the results with those of legal immigrants. To measure the overall effect of the reform we use a timing-of-events approach. In particular, we estimate a multivariate migration rate model which aims to detect a change in the age of initial migration and that of a return following the change in law. In our empirical analysis, we use survey data of Mexican households provided by the

[2]Immigrants who stay longer than 6 months outside the U.S. risk losing their Legal Permanent Residence permits.

Mexican Migration Project (MMP).

Since the IRCA is a comprehensive policy change that may have affected all immigrants to the U.S. there is no natural control group. Thus, previous studies on the effect of the IRCA use different identification strategies. Orrenius and Zavodny (2003) and White et al. (1990) use time dummies to measure the effect of the IRCA on apprehension levels to ascertain whether the policy reduced undocumented migration. Donato et al. (1992) also used annual time dummies to analyze the trend of first and repeat migration and apprehension levels after the IRCA. While White et al. (1990) find that the IRCA reduced apprehension rates in the first two years, further analysis reveals that apprehensions fell in the few months after the law but reverted to the pre-IRCA levels after that (Orrenius and Zavodny, 2003). Donato et al. (1992) also agree that the IRCA did not affect the rate of migration to the U.S. and find that it did not change repeat migration patterns either.[3]

Several studies on migrants in the U.S. differentiate between individuals whose trip initiated before and after the IRCA. The conclusion from these studies is mixed. Reyes (2001) and Li (2016) find that the duration of Mexican migrants trip increased for those who moved after the IRCA, while Quinn (2014) finds no change. However, this analysis does not take into account the effect of the IRCA on the many migrants whose trip started before the policy but lasted long enough to be affected by it.

Similar to the work of Donato et al. (1992), we attempt to identify the effect of the IRCA by observing the change over time in a Mexican individual's conditional probability of migration and return. However, we use an alternative identification

[3]Researchers have studied the effect of the IRCA on other aspects of migration as well. To evaluate the effect of the legalization component, comparison of legalized individual's behavior before and after the IRCA is common as well as comparison of legalized individuals with comparable native population (Amuedo-Dorantes et al., 2007; Amuedo-Dorantes and Bansak, 2011; Kossoudji and Cobb-Clark, 2000). Another strategy to measure the overall effect of the IRCA is to use the change in the legalized population as proxy for the IRCA ((Reyes, 2004; Massey and Espinosa, 1997; Baker, 2015)). Arguing that legalization was the most salient part of the law, Baker (2015) uses the ratio of legalized migrant population in a county to identify the effect of the IRCA on the level of crime.

strategy by examining the year-by-year change in the conditional probability of migrating and the conditional probability of return migration. As in comparable migration studies, we focus on Mexican males distinguishing various groups of immigrants.[4] The *legal* immigrant population of the U.S. consists of two groups of migrants. *Legal residents* are non-citizens allowed to live and work in the country permanently by a permit termed Legal Permanent Resident (LPR). *Naturalized citizens* are foreign-born individuals who became citizens of the U.S. The non-immigrant population or *temporary migrants* include students, holders of various temporary work permits and their family but does not include short-term visitors for pleasure and business. Lastly, *unauthorized migrants*, also known as illegal immigrants and illegal residents, are foreign-born individuals who reside in the U.S. but are neither legal immigrants, temporary migrants, nor short-term visitors. In our analysis we focus on unauthorized immigrants from Mexico who entered the U.S. without authorizing documents and legal immigrants who hold LPR permits. [5] We find that the IRCA was effective in reducing the first-time uptake of an unauthorized trip to the U.S. by young males. The IRCA has not affected their initial duration of stay. In addition, the IRCA did not affect the legal migration rate or the return from a legal trip by Mexican immigrants.

Our contribution to the literature on immigration policy is threefold. First, we provide a concise account of unauthorized migrants' behavior after the introduction of the IRCA. We investigate whether there was indeed a one-time effect and assess the effectiveness of the IRCA in reaching its objectives. Second, we study the effect of the immigration policy on the age of onset of migration and the duration of the first migration spell using hazard rate analysis. Hazard rate analysis has the advantage of allowing for time-varying variables to affect an individual's behavior over time. It also takes into account that the behavior of an individual may change as the individual gets older or as the trip progresses. Third, we use

[4]In Altangerel and van Ours (2017) we analyzed the effects of the IRCA on all Mexican immigrants to the U.S. finding that Mexican men and women tend to have different immigration behavior.

[5]Thus, the legal immigrants in our analysis do not include citizenship holders, as only 0.5% of our migrant sample held citizenship at the time of their first entry, in contrast with the 8% who held LPR permits and 83% who entered unauthorized.

a rich dataset that covers migrants from 154 communities in 24 out of 32 states in Mexico. The large dataset allows us to measure both migration and return behavior over time in each individual and take into account important factors that affect behavior.

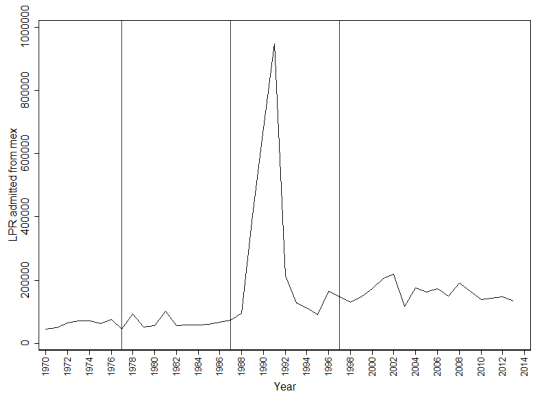
Our paper is structured as follows. In the next section, we give a brief overview of the IRCA and the Mexican immigration to the U.S. Section 3 describes our data from the Mexican Migration Project. Section 4 sets out the empirical migration rate model based on the age of onset of migration and presents relevant parameter estimates. Section 5 discusses the set-up of the return migration model based on the duration of the first trip and presents related parameter estimates. Section 6 concludes.

2.2 Immigration Reform and Control Act

Under the legalization program of the IRCA 3.0 million illegal immigrants applied for legal residence and 2.7 million of them eventually received a permanent resident status (Baker, 2010). Of these, 1.1 million received LPR permits as a special agricultural worker. The legalized migrants represented the majority of the 3-5 million illegal immigrants present in the country at the time (Rytina, 2002). Illegal immigrants who demonstrated eligibility to legal residence under the law were not subject to deportation and were allowed to work upon enactment of the law. The application window lasted for 12 months starting in May 1987. Eligible migrants received a legal temporary residence permit and 1.5 years later were able to apply for LPR permits. Thus 95 percent of the actual receipt of residence permits happened during the period of 1989 to 1991 (Figure 2.1; Baker (2010)). Those legalized under the IRCA were not subject to the annual quota for granting of LPR permits that generally apply to legal migration. About 70 percent of the applicants under the IRCA legalization program were immigrants from Mexico.

As a second major component of the IRCA, border enforcement staff were increased by 50 percent. The budget allocated for the Border Patrol increased 82%

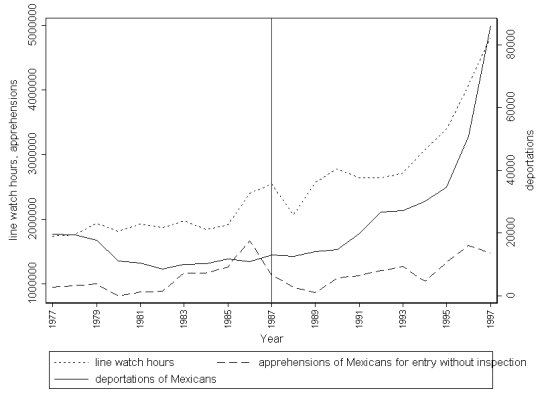
FIGURE 2.1: LEGAL RESIDENCE PERMIT HOLDERS ADMITTED ANNUALLY FROM MEXICO.



SOURCE: MMP

between 1986 and 1991. However, due to the increase in time allocated to other non-border activities, per-officer time spent on patrolling the border declined significantly resulting in a modest change in the levels of total time spent on border patrol activities (see Figure 2.2; U.S. General Accounting Office (1992)). In 1994, the number of border enforcement staff as well as the time spent on border patrol activities took a sharp upturn.

FIGURE 2.2: BORDER ENFORCEMENT.

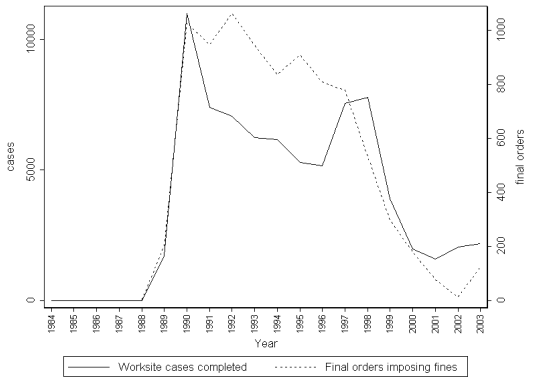


SOURCE: MMP

Lastly, the IRCA introduced, for the first time in the U.S., employer sanctions for hiring unauthorized immigrants, which potentially affected 7 million employers in the U.S. (General Accounting Office, 1987). With the introduction of the IRCA,

employers were required to verify and document new recruits' identities and work permits. After a two year public education period, employer sanctions came into full effect in 1988. The Government Accountability Office reported in 1990 that the initial implementation of the IRCA was satisfactory (GAO, 1990). However, due to fear of discrimination against foreign workers, the employers' burden of verification was relatively small and enforcement of the policy fell over the years (Figure 2.3; US Congress. Senate. (1996); Cooper and O'Neil (2005).

FIGURE 2.3: EMPLOYER SANCTIONS



SOURCE: AUTHOR'S CALCULATIONS BASED ON 1997-2003 YEARBOOKS OF IMMIGRATION STATISTICS (USDHS) AND BROWNELL (2017).

2.3 Mexican Migration Project

Our data are from the Mexican Migration Project (MMP154), an annual survey of Mexican households conducted by a team of researchers based at the University of Guadalajara and Princeton University.[6] The collection of social and economic data on the Mexico-U.S. migration started in 1982 and is freely accessible for research.

Every year the MMP research team chooses 3-5 communities in Mexico non-randomly, with the objective to include communities with positive out-migration to the U.S. and to obtain a representative sample of small villages, towns, mid-

[6]The MMP database and codebook are available from mmp.opr.princeton.edu.

size cities as well as metropolitan areas (Durand and Massey, 2004c). The team interviews a random sample of about 200 households in each community. They collect information about each member of the household, both those in Mexico and the U.S., in addition to socio-economic characteristics of the household. If a household member ever took a migratory trip to the U.S., the year of the first trip, the number of trips, documentation and duration information on the first and last trips to the U.S. are recorded. Although the researchers interview households mainly in Mexico they also interview a small number (3.1% of individuals in the MMP154 sample) that originate in these communities but are located in the U.S. The latter represent the sample of permanent settlers in the U.S.

Since 1982, the MMP survey covered 154 different communities in 24 states out of 32 in Mexico. A great advantage of MMP-data over other sources of migrant data is that it distinguishes between various types of entry - undocumented, as a naturalized citizen, or a permanent resident, with a tourist visa, or a work visa. The survey also notes whether and when an immigrant received legal immigrant status. Despite being non-representative it is argued that the MMP data correctly captures the migration behavior of an average Mexican immigrant[7].

The MMP dataset defines a trip to the U.S. if it is to a residence that involves employment, search for work, or an otherwise 'reasonably stable' residence (Mexican Migration Project and Latin American Migration Project, 2012). A short trip to the U.S. for tourism or family visit purposes is not considered a trip nor is a trip that was cut short at the outset by a border apprehension. Likewise, a short

[7]As the survey tends to over-sample communities with significant levels of migration to the U.S., the data are representative of the communities surveyed but not of the Mexican population or all Mexican immigrants to the U.S. (Durand and Massey, 2004a). Furthermore, those who migrated to the U.S. as a whole family are less likely to be covered since the household is not in Mexico to be surveyed. As long term migrants are more likely to have traveled as a whole family, this may bias the MMP sample toward migrants with shorter durations. Durand and Massey (2004a) compared the MMP with the National Survey of Population Dynamics (ENADID) conducted by the Mexican National Institute of Statistics and Geography (INEGI) which is representative of the Mexican population with migration experience to the U.S. They concluded that, except for community location and size, the main characteristics and U.S. trip duration of MMP migrants and ENADID migrants to the U.S. are consistent. Hanson (2006) compared the MMP with the Mexico's Census of Population and Housing and the Mexican-born migrants in the U.S. Census of Population and Housing concluding that the characteristics of the non-seasonal (permanent) migrants in both samples are similar.

trip to Mexico during a residence in the U.S. is not considered to be a return trip. Due to unidentifiability of the communities in the MMP, we use municipality and community data supplied by the MMP measured by censuses of 1960, 1970, 1980, 1990, 2000 and 2010. Thus, municipality characteristics in our data take their nearest available values. The documentation that a migrant had at the time of their first main job is defined as the entry documentation and defines whether the first trip in our data is considered unauthorized or legal. Appendix 2.A provides details on the data we used.

2.4 First migration to the U.S.

2.4.1 Descriptives

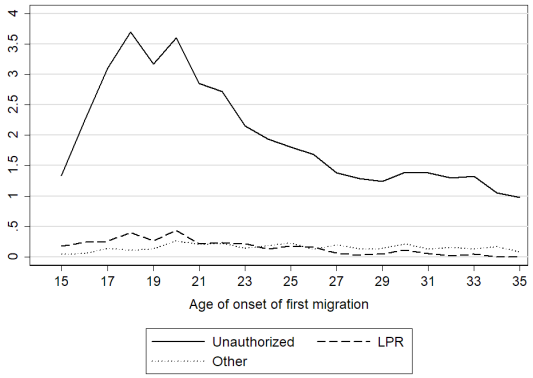
We assume that individuals do not migrate before age 15 and we model the duration until first migration as the age of onset minus 14.[8] We focus on unauthorized migration and migration with an LPR document and specify the age of onset of migration in a competing risk model to allow for dependence in an individual's hazard rates of unauthorized and legal migration. We observe all male individuals who turned 14 between 1976 and 1985 (within a 10-year period before IRCA) and follow them until the age of 35. The dependent variable in the age of onset analysis is the number of years from age 14 until an individual takes his or her first legal or unauthorized migration to the U.S. or is right-censored by age 36, the survey, death, or migration to the U.S. with another type of documentation, for example a tourist visa.

Figure 2.4(a) shows the conditional migration rates by age for an individual's first trip to the U.S. These rates are specified as the probability to migrate at a certain age conditional on not having migrated up to that age. We distinguish between undocumented migration ("unauthorized migration"), migration with an

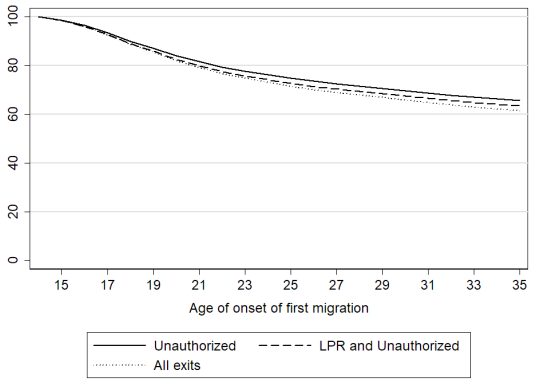
[8]Age 15 is the age around which individuals may decide to embark on a migration trip independently. In the original sample of all migrants more than half of the migrants had traveled to the U.S. before the age of 21, but only 9% had migrated the age of 14.

FIGURE 2.4: EMPIRICAL MIGRATION AND SURVIVAL RATES FOR AGE OF ONSET OF FIRST MIGRATION

(a) Migration rates (%)



(b) Survival rates (%)



LPR permit ("legal migration") and other types of documents. Clearly, the undocumented migration rate is by far the largest. It increases from about 1.3% at age 15 to about 3.5% at age 18 to 20 and slowly declines after that. The legal migration rates and other type of migration rates are all below 0.5% per year. Figure 2.4(b) shows the related survivor rates. By their mid-thirties about 34% of the Mexicans in our sample have taken at least one unauthorized trip to the U.S. The other ways of migration to the U.S. are relatively very small.

2.4.2 Statistical model

We model the age of onset of migration using a Mixed Proportional Hazard (MPH) specification. The MPH specification assumes a proportional effect of observed covariates and unobserved individual-specific components. Likewise, the effect of the IRCA is assumed to be multiplicative. An individual migration rate to destination u (unauthorized) or l (legal) at duration (age) t conditional on observed characteristics x_t, the time-varying policy regime D_t and time-invariant unobserved characteristics v is specified as follows (ignoring a subscript for individual):

$$\theta^j(t|x_t, D_t, v_j) = \lambda_j(t) \exp(x_t\beta_j + \delta_{\text{IRCA},j} D_t + v_j) \qquad \text{for} \quad j = u, l \tag{2.1}$$

The vector of background parameters to be estimated is represented by β_j. The vector of covariates x_t includes time-invariant and time-varying variables. Time-invariant variables include education at the time of the survey[9], migrant cohort represented by birth year minus 1950, and the community share of household heads who were in the U.S.[10] The share is measured in the year the spell started and is time-invariant. Dummies for states of birth are included to allow for state-fixed effects not captured by the municipality variables.[11] Time-varying variables are included to control for the home community's socioeconomic characteristics. These are the community population, share of male labor force in manufacturing, and percentage of municipality labor force earning more than double the minimum wage. To control for time-varying labor demand factors, we include one-period lagged unemployment rate of the Hispanic and Latino population in the U.S. Lastly, to control for other U.S. immigration policies that might have affected migration behavior we include 1 period lagged annual number of Mexican's deported from the U.S. We include deportation as a proxy variable for two other immigration laws followed the IRCA within the observation period. The immigration laws

[9] We take education as a proxy for unobserved ability of an individual migrant.

[10] Only 14% of our total sample are heads of households, 37% of whom have taken at least one trip to the U.S. within our observation window. The rest of the sample consist of other members of the household.

[11] For 92.4% of the individuals in the main sample, their state of birth and last state of household residence coincide.

enacted in 1990 and 1996 made deportation procedure of unauthorized migrants easier[12]. As figure 2.2 shows, deportations of Mexicans remained relatively stable until 1990 after which it increased substantially. As can be also seen, the IRCA has changed only the line-watch hours at the border, although the latter had also seen a strong increase since about 1994.

The parameters of main interest are $\delta_{\text{IRCA},j}$ – the effects of the IRCA on unauthorized or legal migration to the U.S. The specification of the effect of the IRCA assumes that individual hazard rate shifts at the age that is equivalent to the year that the IRCA is effective and not before. For instance, if an individual in Mexico was 19 years of age at the time IRCA was enacted, we allow for a permanent shift in the individual's hazard rate of migration at the age 19. As the IRCA was enacted on Nov 6, 1986 we take the year 1987 as the year the IRCA went into effect. The timing of enactment of the law was difficult to be foreseen by migrants. Although the reform was discussed by policy-makers for about a decade, the debates around and opposition to the law by legislative authorities created an uncertainty about its implementation.[13] After controlling for time trend, personal characteristics, home and destination characteristics, and other immigration policies, we expect that our measure of the average effect of the IRCA is not confounded by other factors that influence migration dynamics. Therefore, we assume that the IRCA caused a shift in the migration rates that is constant over time.

Duration dependence is specified as a step-function with $\lambda_j(t) = \exp(\Sigma_k \xi_{j,k} I_k(t))$, where k (= 1,..,10) is a subscript for age categories and $I_k(t)$ are time-varying dummy variables that are one in subsequent categories, 9 of which are for individual ages (age 15,...,23) and the last interval is for ages above 24 years. Because we also estimate constant terms, we normalize $\xi_{j,1} = 0$.

The conditional density functions for the completed durations until migration to

[12]The law of 1990 also made changes to the legal admissions quota.

[13]Orrenius and Zavodny (2003) reached a similar conclusion that illegal immigrants did not change their behavior in expectation of the IRCA.

the U.S. either as an unauthorized or as a legal migrant is

$$f^{ul}\left(t \mid x_t, D_t, v_u, v_l\right) = \left(\left(\theta^u\left(t \mid x_t, D_t, v_u\right) + \theta^l\left(t \mid x_t, D_t, v_l\right)\right)\right.$$
$$\left.\exp(-\int_0^t \left(\left(\theta^u\left(s \mid x_t, D_t, v_u\right) + \theta^l\left(s \mid x_t, D_t, v_l\right)\right)ds\right. \tag{2.2}$$

We integrate out the unobserved heterogeneity component assuming that they follow a discrete distribution with four points of support and the associated probabilities

$$\Pr(v_u = v_{u,1}, v_l = v_{l,1}) = p_1, \;\; \Pr(v_u = v_{u,1}, v_l = v_{l,2}) = p_2$$
$$\Pr(v_u = v_{u,2}, v_l = v_{l,1}) = p_3, \;\; \Pr(v_u = v_{u,2}, v_l = v_{l,2}) = p_4$$

which are modeled using a multinomial logit specification, $p_h = \frac{\exp(\rho_h)}{\Sigma_h \exp(\rho_h)}$, with $h = 1, 2, 3, 4$ and ρ_4 normalized to zero. Because we estimate constants, we also normalize $v_{u,2}$=$v_{l,2}$=0. In the specification of the likelihood function incomplete durations and the interval nature of our data are taken into account (see Altangerel and van Ours (2017) for details).

2.4.3 Parameter estimates migration rates

The parameters of our model are estimated using the method of maximum likelihood and reported in Table 2.1. The first column shows the parameter estimates for the unauthorized migration rate and the second column shows parameter estimates for the legal migration rates. Initially, as indicated before, unobserved characteristics were assumed to follow a discrete distribution with four points of support. However, we found unobserved heterogeneity to be perfectly correlated across the two migration rates, i.e. we identified a discrete distribution with two points of support. Apparently, conditional on the observed characteristics, there are two types of migrants, those who are more likely to migrate with or without documentation and those who are less likely to migrate. The proportion of the

latter in the sample is estimated to be 30 percent.

The IRCA seems to have had a negative and significant effect on undocumented migration. It decreased the conditional probability of undertaking an undocumented trip to the U.S. by 13%. The effect of the IRCA on legal migration is positive but it does not differ significantly from zero. Furthermore, we find that education has a non-linear effect on the age of onset of migration. The hazard rate of migration is lower at the low end and at the high end of the educational distribution. Poorer economic opportunities in the home country trigger migration at an earlier age, especially undocumented, as can be seen from the effect of origin community characteristics. The effect of coming from a larger community, and a larger share of workers earning high wages in the community are negative and significant on the undocumented migration rate. The effect of home community size is similar on legal migration rates as well, but a greater share of workers earning high wages affects the legal migration rate positively. As expected, having members of the community in the U.S. increases both migration rates. This may be because a network in the U.S. lowers migration costs and because it is easier to obtain an LPR permit as family member of a current migrant. Higher unemployment rates among Hispanics/Latino's in the U.S. have a negative effect on migration rates although the effect on legal migration is not significantly different from zero. The laws enacted in 1990 and 1996 to expedite unauthorized migration deportation seem to have had a positive effect on the undocumented migration rates. There is a positive but nonlinear trend in the rate of undocumented migration. Duration dependence in the hazard rate has an inverted U-shape for unauthorized and legal migration as was shown in Figure 2.4.

2.4.4 Sensitivity analysis and simulation results

To check whether the effects of the IRCA can be related to one or more of its components, we added to the IRCA dummy variable in the main model time-varying variables signifying each major component of the law: the (log of) annual linewatch hours at the border for the enforcement, an indicator for active employer

TABLE 2.1: PARAMETER ESTIMATES COMPETING RISK MODEL MIGRATION RATES INTO THE U.S.: UNDOCUMENTED AND LEGAL

	Undocumented		**LPR**	
Panel A. Baseline model				
Effect of IRCA	-0.140*	(0.076)	0.104	(0.208)
Personal characteristics				
Years of education	0.232***	(0.026)	0.533***	(0.097)
Years of education squared	-0.017***	(0.001)	-0.025***	(0.005)
Community characteristics at origin				
Size	-0.083***	(0.031)	-0.111**	(0.049)
Males in manufacturing	-0.005	(0.007)	-0.027***	(0.008)
Double min. wage	-0.014***	(0.005)	0.015**	(0.007)
Migrant community	0.067***	(0.017)	0.066***	(0.009)
Immigration policy and unemployment at destination				
Hispanic/Latino unemployment	-0.063***	(0.014)	-0.036	(0.057)
Deportation	0.569***	(0.127)	0.215	(1.001)
Cohort	-0.076	(0.088)	0.241	(0.276)
Cohort squared	0.003	(0.003)	-0.007	(0.008)
Year trend	0.397***	(0.107)	0.441	(0.932)
Year trend squared	-0.005***	(0.001)	-0.007	0.013
Constant	-15.141***	(3.134)	-21.442	(26.129)
Age dependence				
16	0.649***	(0.097)	0.440*	(0.240)
17	1.114***	(0.117)	0.662**	(0.287)
18	1.433***	(0.129)	1.301***	(0.370)
19	1.404***	(0.148)	1.055***	(0.412)
20	1.643***	(0.166)	1.701***	(0.426)
21	1.500***	(0.158)	1.143**	(0.513)
22	1.516***	(0.186)	1.338**	(0.540)
23	1.343***	(0.194)	1.398**	(0.594)
24 +	1.227***	(0.221)	1.285*	(0.713)
Unobserved heterogeneity				
ρ_1		-0.854*	(0.483)	
v_1	-2.145***	(0.800)	-1.142	(0.848)
- Log-likelihood = 20428.1				
Panel B. Effects of IRCA components				
Effect of IRCA	-0.133	(0.093)		
LPR admissions	-0.128***	(0.046)		
Line-watch hours	0.176	(0.292)		
Employer sanctions	0.056	(0.138)		
- Log-likelihood = 20413.8				

The table shows estimation results for a competing risk model for two types of entries into the U.S.: undocumented and as an LPR permit holder. Size: (log) community population. All origin community and destination characteristics except for *migrant community* are time-varying variables. Origin state coefficients are not reported. Panel B: shows coefficients of the (log) annual LPR admission, (log) annual line-watch hours, and an indicator for active employee sanctions along with the baseline estimation. Models were estimated with the same specification as in Panel A; the IRCA dummy for age of onset of unauthorized migration and return from an unauthorized migration was supplemented with the (log) annual LPR admissions, (log) annual line-watch hours, and an indicator for years after 1988 for the beginning of employer sanctions. Based on 14,580 observations; in parentheses clustered standard errors at the level of the community; $^{*}p < 0.10, ^{**}p < 0.5, ^{***}p < 0.01$.

sanctions policy, and the (log of) the annual number of Mexican LPR recipients for the legalization component. The results presented in panel B indicate that the number of Mexican LPR recipients is significantly different from zero while line-watch hours and employers sanctions are not. This could be due to several factors. Reyes (2007) finds that border enforcement was positively associated with undocumented migration suggesting that for the enforcement to be effective a certain high level is necessary. Massey and Espinosa (1997) posit that preemptive migration might explain ineffective border policy if individuals undertake migration sooner to preempt further increases in border enforcement. Gathmann (2008) finds that migrants change their route of entry when border enforcement does not increase evenly in all places.

Massey and Espinosa (1997) found that having legalized family members greatly increased the odds of an undocumented trip to the U.S. Thus, unauthorized migration rates may have been affected by the undocumented entry of family members of legalized migrants. To allow for this possibility, we exclude from the sample the 22 households with at least one legalized member. As was to be expected, the parameter estimates are not affected by this exclusion.

To illustrate the magnitude of some determinants and the effects of the IRCA on unauthorized migrants we perform simulations of undocumented migration rates by age 30 based on the characteristics of the median migrant and the parameter estimates of Table 2.1. As shown in Table 2.2, the unauthorized migration probability by age 30 for a Mexican man with the median characteristics was about 44% before and 40% after the IRCA, a drop of 4%-points.

The simulations also show important wage effects. Before the IRCA, if the share of the population earning more than double the minimum wage increases from the 25-th to the 75-th percentile, the undocumented migration probability by age 30 goes down with about 12%-point. There is also a big effect of migrant networks. An increase of migration network ratio from the 25-th to the 75-th percentile leads to about 18.5%-point increase in undocumented migration by age 30. Similarly, the effect of U.S. labor market conditions is considerable. If the Hispanic/Latino

Table 2.2: Predicted undocumented migration proabilities by age 30

	Before IRCA	After IRCA	Δ
Median individual	44.1	40.2	-3.9
Double min. wage = 16.5 (25-th percentile)	49.6	45.6	-4.0
Double min. wage = 39.7 (75-th percentile)	37.6	34.0	-3.6
Migrant community = 1.5 (25-th percentile)	37.6	34.0	-3.6
Migrant community = 11.2 (75-th percentile)	56.1	52.1	-4.0
Hispanic/Latino unemployment = 7.4 (25-th percentile)	46.8	42.8	-4.0
Hispanic/Latino unemployment = 10.5 (75-th percentile)	41.3	37.5	-3.8

Note: The table shows predicted migration rates by or at age 30 before and after IRCA for a selection of individuals in Mexico. All numbers are in percentages. The median characteristics are taken to be as follows (median of the sample): He is born in 1967, has 9 years of education as of the survey, and comes of age 14 in a community where 5 percent of household heads are in the U.S. He comes from a community of a population of 5000, where 26% of male labor force work in manufacturing, and 27% of workers earn above double the minimum wage. During the observation period, the median U.S. unemployment rate for men of Hispanic/Latino origin was 8.85% and about 20,000 unauthorized Mexican migrants were deported in a year. He comes from the state Jalisco. Before (after) IRCA estimations assume that the entire spell unaffected (affected) by IRCA.

unemployment rate increases from its 25-th to the 75-th percentile, undocumented migration rates fall by about 5.5 percentage points. The IRCA-effect is about the same for all types of situations. This is due to the IRCA-effect being specified as a multiplicative effect in the migration rate.

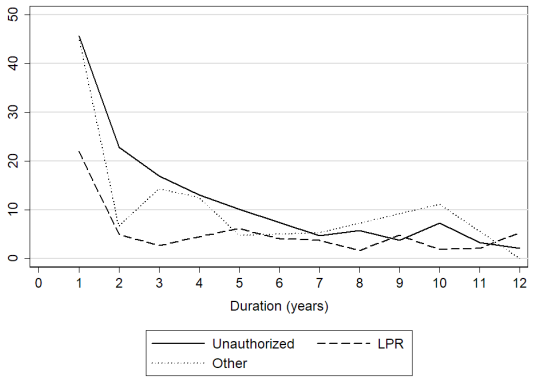
2.5 Return migration rates

2.5.1 Descriptives

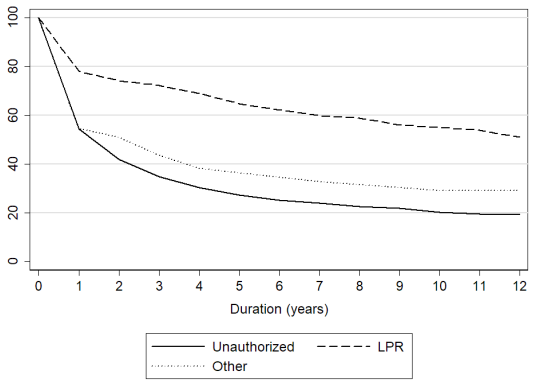
We analyze the duration of the first migration trip to the U.S. which started in the years 1976 to 1985. The spells are observed for up to 12 years until an individual returns to Mexico or is right censored by the end of observation period or the survey year. We include only first trips due to availability of data.

FIGURE 2.5: EMPIRICAL HAZARD AND SURVIVAL RATES OF RETURN MIGRATION

(a) Return rates (%)



(b) Survival rates (%)



The empirical rates of return from the trip indicate that the trip features strong negative duration dependence. The top graph of Figure 2.5 shows the empirical (hazard) rates of return from the first trip. Legal migrants have a significantly lower return rate in the first decade after migration compared to that of unauthorized migrants. The bottom graph of Figure 2.5 shows indeed that the duration of the first legal migration trip to the U.S. is substantially longer than the duration of other types of migration. The median duration of unauthorized and other migration is about 1-2 years while the median duration of the first trip of legal migration is about 12 years.

2.5.2 Statistical model

The duration of the first trip of a migrant to the U.S. is measured in years. We specify the return rate at duration τ conditional on observed characteristics $x_{2,t}$ and unobserved characteristics w as

$$\theta^j(\tau|x_{2,t}, D_\tau, L_\tau, w_j) = \gamma_j(\tau)\exp(x_{2,t}\alpha_j + \sigma_{\text{IRCA},j}D_\tau + \sigma_{\text{Legal},u}L_\tau + w_j) \quad \text{for} \quad j = u, l \tag{2.3}$$

in which j indicates the nature of the first trip in terms of the legal framework: unauthorized or legal. Furthermore, vector $x_{2,t}$ contains in addition to the characteristics in x_t characteristics of the first trip in terms of first main destination (California, Illinois, Texas or other state), type of first main occupation in the U.S. (agricultural, unskilled manufacturing, skilled manufacturing, service or other industry), and the initial wage in the U.S. The time-varying background variables representing the home community and destination in $x_{t,2}$ are lagged by 1 year. For the time-invariant network variable we take the value observed at the start of the migration trip. The variable D_τ indicates whether a spell interval covers a post-IRCA period, i.e. occurring in or after 1987. By introducing the variable L_τ that indicates whether an unauthorized immigrant obtains a LPR permit during an interval, we allow for a shift in the hazard rate when an illegal immigrant becomes legal during the first trip.[14] This is done to separate the effect of the IRCA on unauthorized immigrants from the effect of legalization. Confounding of newly legalized migrants with other unauthorized migrants will cause a bias in measuring the effect of the IRCA as the maintenance of a legal status has a requirement of continued stay in the U.S. which reduces the hazard rate of return. The main parameters of interest are the $\sigma_{\text{IRCA},j}$ that indicate the effect of the IRCA on return migration. For both return hazards we allow for unobserved heterogeneity which is specified as a discrete distribution with two points of support.[15]

[14] Legalized migrants include migrants legalized under the IRCA or the Immigration and Nationality Act. Note that we assume this legalization to be exogenous to the return migration rate.

[15] Based on LR test statistics we choose the model without unobserved heterogeneity for the return hazard from an LPR migration and normalize $w_{l,1} = w_{l,2} = 0$. In a separate analysis we

The conditional density functions for the completed durations of the first trip either as an unauthorized or as a legal migrant is specified for $j = u, l$ as follows:

$$g^j(\tau \mid x_{2,t}, D_\tau, L_\tau, w_j) = \theta^j(\tau \mid x_{2,t}, D_\tau, L_\tau, w_j) \exp(-\int_0^\tau \theta^j(s \mid x_{2,t}, D_\tau, L_\tau, w_j))ds \tag{2.4}$$

We integrate out the unobserved heterogeneity component with points of support $w_{j,1}$ and $w_{j,2}$ and associated probabilities p_j and $1 - p_j$ where $p_j = \exp(\varrho_j)/(1 + \exp(\varrho_j))$. We normalize $w_{j,2} = 0$ and since duration is measured in years, we account for the interval nature of the data in the log-likelihood contribution as before.

2.5.3 Parameter estimates return migration rates

The parameter estimates of the effect of the IRCA on the return migration rate of the first trip to the U.S. and the effect of legalization of unauthorized migrants are shown in Table 2.3. These estimates indicate that legalization of an undocumented migrant decreased the return rate by about 34%. After accounting for this effect, the IRCA is estimated to increase the return migration rate for undocumented migrants, by about 34%. The IRCA did not have a significant effect on the return rates of legal migrants.

As predicted, the results show that there is a negative duration dependence in the return rate from first migration while there is a stark difference in the return rates for legal migrants between the first year and later years. By the second year of migration, the conditional probabilities of return for both unauthorized and legal migrants drop by more than 80%. As in the case of duration until first migration, the results indicate presence of unobserved heterogeneity in the return rate of undocumented migrants. We identify two types of individuals in the sample, one with a shorter duration and one with a much longer duration. The proportion of

investigated whether there is correlation between unobservables in the migration rate and the return migration rate. This turned out not to be the case.

Table 2.3: Parameter estimates return rates from the first trip to the U.S. by migrant status

	Undocumented		**LPR**	
Panel A. Baseline model				
Effect of IRCA	0.292**	(0.135)	0.344	(0.396)
Effect of legalization	-0.422*	(0.221)		
Personal characteristics				
Years of education	-0.039	(0.026)	0.121***	(0.039)
Years of education squared	0.003*	(0.002)		
Age at entry	0.089	(0.062)	0.327*	(0.185)
Age squared	-0.001	(0.001)	-0.007*	(0.004)
Married	0.277**	(0.116)	0.482	(0.717)
Community characteristics at origin				
Size	0.039	(0.030)	-0.025	(0.089)
Double min. wage	0.002	(0.006)	-0.025**	(0.011)
Males in manufacturing	-0.005	(0.006)	0.058***	(0.018)
Migrant community	0.013**	(0.006)	0.028**	(0.011)
Destination characteristics				
Hispanic/Latino unemployment in state	0.006	(0.015)	-0.095*	(0.055)
Deportation	-0.083	(0.122)	0.461	(0.481)
Initial wage	-0.033***	(0.008)	-0.042**	(0.016)
California	-0.002	(0.115)	-0.146	(0.230)
Illinois	-0.004	(0.147)	-0.268	(0.770
Texas	0.526***	(0.164)	-0.029	(0.460)
Occupation in the U.S.				
Agricultural	0.647***	(0.095)	1.749***	(0.289)
Unskilled manufact.	0.043	(0.095)	0.212	(0.311)
Skilled manufact.	-0.208**	(0.094)	0.144	(0.403)
Service	0.228**	(0.107)	-0.490	(0.490)
Cohort	0.052	(0.230)	-0.209	(1.188)
Cohort squared	-0.001	(0.004)	0.003	(0.020)
Constant	-1.328	(4.329)	-7.321	(20.909)
Duration dependence				
Year 2	-0.719***	(0.078)	-1.176***	(0.333)
Year 3	-0.981***	(0.113)	-1.817***	(0.544)
Year 4	-1.192***	(0.141)	-1.305***	(0.400)
Year 5	-1.425***	(0.183)	-0.955**	0.483
Year 6	-1.700***	(0.196)	-1.303**	(0.646)
Year 7	-2.160***	(0.247)	-1.397**	(0.549)
Year 8	-1.922***	(0.229)	-2.189***	(0.847)
Year 9	-2.342***	(0.283)	-1.082	(0.808)
Year 10 +	-1.738***	(0.244)	-0.921	(0.743)
Unobserved heterogeneity				
ϱ	-2.762***	(0.598)		
w_1	-2.085**	(0.685)		
- Log-likelihood	5000.7		364.1	
Observations	3258		310	
Panel B. Sensitivity analysis: No agricultural workers				
Effect of IRCA	0.210	(0.154)	0.471	(0.432)
Effect of legalization	-0.337	(0.237)		
- Log-likelihood	3688.9		295.5	
Observations	2195		247	

The table shows estimation results for the hazard rates of return from either an undocumented or a legal migration with an LPR permit. Size: (log) community population. All origin community and destination characteristics except for *migrant community* and initial destination and wage are time-varying variables. Origin state coefficients are not reported. Panel B: The sensitivity analysis excludes sample of migrants who worked in agriculture. In parentheses clustered standard errors at the level of the community; $^{*}p < 0.10,^{**}p < 0.5,^{***}p < 0.01$.

the latter in the sample is estimated to be about 6% of undocumented migrants.

Education has a negative but nonlinear effect on the return rate for undocumented immigrants and a positive effect on the return rate for legal migrants. Age at entry has a positive nonlinear effect on the hazard rate of legal migrants. Age at entry has no effect on the return rate of unauthorized migrants. Unauthorized migrants to Texas tend to have the highest return rates. The parameter estimate for the migrant community variable indicates that presence of members of the home community in the U.S. stimulates higher rates of return migration. This might result from several factors. Presence of a network reduces initial costs of migration leading to less time in the U.S. to recuperate the cost. Also, as suggested by Lindstrom (1996), due to less cost per trip the presence of a network might encourage circular migration.

We have noted that agricultural workers are overrepresented in the MMP sample compared to the Mexican migrant population in the U.S. Workers in agriculture represent 20% of the migrant sample. We check the robustness of our findings in respect to return migration by analyzing a sub-sample which excludes workers in agriculture, but not in other agricultural sectors such as animal husbandry, forestry and fisheries. Now, all parameter estimates are insignificantly different from zero (panel B of Table 2.3). From this we conclude that our results are indeed sensitive to the inclusion of agricultural workers.

2.6 Concluding remarks

In our study, we measure the effects of an immigration reform, the IRCA, on the male migration rate from Mexico to the U.S. and the return migration rate from the U.S. to Mexico. We use the rich survey dataset provided by the Mexican Migration Project. Our study contributes to the current literature on the effect of the IRCA by measuring the overall effect of the policy and using a change in individual's behavior over time to identify the effect. In doing so, we attempt to control explicitly for the effect of selection and other confounding factors.

We provide evidence that the IRCA may have been effective in reducing the unauthorized immigrant inflow once we take into account confounding factors. After we control for the trend in the migration rate, individual characteristics, and variable push and pull factors, the IRCA appears to have reduced unauthorized migration to the U.S. We also find that the IRCA did not have significant effects on the rate of legal migration or the duration of the first legal migration trip.

The IRCA as a comprehensive reform has had a substantial effect on immigration. It consisted of different policy measures that intended to control and deter unauthorized migration by increasing the difficulty of illegal entry, and of finding and keeping a job while unauthorized. The IRCA seems to have affected unauthorized migration to the U.S. largely through its legalization program. Since this legalization program was active only for some years, the long term effects of the IRCA are probably limited. In the two decades following the IRCA, the number of unauthorized immigrants increased threefold and the duration of stay increased as well. The literature on the effect of IRCA has reached the conclusion that, if IRCA has been effective, it was only in the short period immediately after the IRCA, but was not effective in reducing unauthorized immigration in the long term (Orrenius and Zavodny, 2003). This is in line with our main findings.

2.A Appendix

Information about our data

As shown in panel A of Table 2.4, the median Mexican individual in the sample has 9 years of education, while median unauthorized migrants have less education.[16] In the year that an individual turned 14, there were on average 8 household heads in the U.S. for every 100 households in the community.[17] Furthermore, 73% of males participate in the labor force, and 21% earned more than double the minimum wage. Compared to the median individual in the sample, those from smaller communities with lower level of economic opportunities have higher migration rates, especially of unauthorized migration. Migration rates, especially those of legal migration, are higher in Mexican communities with a larger network in the U.S.. In the sample of 14,580 individuals in Mexico in our observation period 29% eventually immigrate as an unauthorized migrant and 3% as legal migrant to the U.S..

Panel B of Table 2.4 provides descriptive statistics about return migration rates. The number of migrants used for the analysis of return migration is smaller than the number of Mexican individuals who immigrated to the U.S. (see Panel A) as we restrict the immigrants in the analysis of return rates to those entering the U.S. between 1976 and 1985. It shows that 79% of unauthorized migrants and 48% of legal migrants have returned to Mexico from their first trip. The median ages at migration are 21 and 20 for unauthorized and legal migrants respectively. Compared to the legal migrants, unauthorized return migrants are from smaller communities with smaller shares of community members in the U.S.. The destination for more than half of the migrant sample is California. Taken together, about three quarters of all migrants are headed to the state of California, Illinois, or Texas. More than one-fifth of both unauthorized and legal migrants work in

[16] Education is measured in years of education and characterizes the migrant at the time of the survey.

[17] The 'migrant community' variable is created using the life history data available for household-head migrants comparing it with the surveyed community.

Table 2.4: Descriptive statistics

a. Duration until the first trip	**Undocumented**	**LPR**	**All**
Sample size	4239	365	14580
Spell starting year, median	1981	1980	1981
Years of education, median (mean)	6 (7.3)	9 (8.9)	9 (8.4)
Infrastructure and Socioeconomic Indicators in Municipality (at age 14):			
Community population, median	4000	6000	8000
Municipality population, median	24000	38000	37000
Males in LF, mean	72	72	73
Males in manufacturing, mean	21	22	21
Double min. wage, mean	17	20	21
Migrant community, mean	11	14	8
Socioeconomic and Policy Indicators in the U.S. (at age 14):			
Unemployment of Hispanic or Latino men	10.9	10.7	10.8
Deportation of Mexicans, mean	13757	14108	13746
b. Duration of the first trip	**Undocumented**	**LPR**	
Sample size	3258	310	
of which not censored (returned)	2579 (79%)	148 (48%)	
1 U.S. trip if migrant %	43	73	
Up to 2 U.S. trips if migrant %	64	79	
Up to 3 U.S. trips if migrant %	75	84	
Spell starting year, median	1981	1982	
Unauthorized migrants legalized, %	12.5		
Number legalized	664		
Age at migration, mean	21	20	
Married at migration, %	29	30	
Infrastructure and Socioeconomic Indicators in Municipality at the beginning of first trip			
Community population, median	4000	6000	
Municipality population, median	24000	38000	
Males in LF, mean	71	70	
Males in manufacturing, mean	21	22	
Double min. wage, mean	16	18	
Migrant community, mean	15	17	
Socioeconomic and Policy Indicators in the U.S. at the beginning of first trip:			
Initial wage, median (mean)	9.3 (10.8)	14.9 (17)	
Unemployment of Hispanic or Latino men, by state	7.1	9.7	
Deportation of Mexicans, mean	13384	13199	
Destination: California %	64	59	
Destination: Illinois %	7	6	
Destination: Texas %	13	16	
Occupation: Agriculture e.o. %	35	23	
Occupation: Unskilled manufacturing %	22	25	
Occupation: Skilled manufacturing %	11	20	
Occupation: Service %	16	11	

Duration until first trip: age of onset minus 14, Years of education as measured at the time of survey, Males in LF: percentage males in municipal labor force, Males in manufacturing: percentage of male labor force in manufacturing, Double min. wage: percentage of workers in municipality who earn more than twice the minimum wage, Migrant community: share of household-heads who were in the U.S. in the year the spell started, U.S. unemployment: national unemployment rate of Hispanic or Latino men aged 16 and above in the U.S. in the year an individual's spell has started, U.S. unemployment by state: state's unemployment rate of Hispanic or Latino men aged 16 and above in the first destination state of migrants in the year an individual's spell has started (source: U.S. Bureau of Labor Statistics), Deportation of Mexicans: Number of deportations of Mexicans from the U.S. in the year an individual's spell has started, Wage: self-reported first U.S. wage (2010 U.S. dollars), Married at migration: marital status at the start of the first U.S. trip (information available for communities 72-154), Agriculture e.o: agriculture, husbandry, forestry, and fishery.

agriculture[18] The average initial hourly wage of legal migrants is 60.2% higher than that of unauthorized migrants.

[18]The occupation variable measures the category of the first main occupation held during the trip.

Chapter 3

The Effect of Documentation on Immigrants' Occupational Outcome and Wages

3.1 Introduction

The literature on the effect of legal immigrant status on immigrant wages reveals a substantial wage premium for having a legal document (Amuedo-Dorantes et al., 2007; Kossoudji and Cobb-Clark, 2002; Lozano and Sorensen, 2011; Pan, 2012; Steigleder and Sparber, 2017). The effect can arise from different factors. These include occupational mobility allowed by the legal status, which leads to a wider range of work opportunities and better job matching. For instance, Barcellos (2010) and Kossoudji and Cobb-Clark (2000) show that unauthorized immigrant men tend to concentrate in a narrow range of traditionally immigrant jobs and tend to move out of these jobs after becoming legalized. Hartog and Zorlu (1999) also find that undocumented workers face a limited choice of sectors to work in compared to documented workers. Steigleder and Sparber (2017) report that the legal status allows immigrants to move away from manual-intensive occupations, where immigrants tend to be overrepresented, to communication-intensive ones.

Another reason is that returns to skills might be different for legal immigrants (Amuedo-Dorantes and Bansak, 2011; Kossoudji and Cobb-Clark, 2002). Availability of public assistance programs such as the unemployment insurance and unemployment benefits and the reduction in the risk of deportation can allow for longer job search, improved bargaining power, and better job matches among legal immigrants (Amuedo-Dorantes et al., 2007). Furthermore, wages may rise due to the reduced legal risk faced by employers of unauthorized immigrants. The threat of employer sanctions leads employers to offer lower wages to unauthorized immigrants (Mukhopadhyay, 2018; Hartog and Zorlu, 1999). Possibility of a long-term residence without a fear of deportation or arrest can incentivize immigrants toward making choices that improve their job market outcomes. These include broadening one's network, learning the local language, and investing in other country-specific assets. Finally, exploitation and discrimination, which can lead to lower wages for unauthorized immigrants, applies much less for the documented. Discrimination of immigrants due to a foreign-sounding name was prevalent even before illegal immigration became common (Biavaschi et al., 2017). Rivera-Batiz (1999) has found that more than 50 percent of the wage difference in the 1980's between legal and unauthorized immigrants could not be explained by the immigrants' characteristics.

This paper analyzes the effect of having the legal resident status on immigrants' occupational outcomes in comparison to being unauthorized, taking into account selection of immigrants into the undocumented status. In addition, the study examines how the effect is changing over time and whether it varies between return migrants and stayers. Finally, the analysis looks at job mobility and wage effects of the legal status. The focus is on Mexican male immigrants to the U.S.

A major impediment to the research on the effect of documentation is the shortage of data containing the status of immigrants. An often used data source on legalized immigrants is the Legalized Population Survey.[1] An administrative database of amnesty applicants was utilized by Borjas and Tienda (1993) to study the ef-

[1]e.g., used by Amuedo-Dorantes et al. (2007); Amuedo-Dorantes and Bansak (2011); Kossoudji and Cobb-Clark (2002); Rivera-Batiz (1999)

fect of legalization. What these data have in common is that they capture only the unauthorized immigrants who were legalized, by an amnesty, typically after prolonged unauthorized stay in the U.S. Thus the datasets capture a subpopulation of unauthorized immigrants. The New Immigrant Survey is another source of information on immigrants receiving a legal permit to stay in the U.S.[2] In addition to being restricted to two waves, this data lacks information on immigrants who do not receive a legal document. Other rich data sources commonly used by researchers are the census, the Current Population Survey and the American Community Survey.[3] Although representative of the immigrant population in the U.S., these surveys lack information on the legal status of immigrants, necessitating an imputation of status or other methods of identification.

A shared feature of the above-mentioned data is that these are collected in the host country and represent the stock of immigrants in the country. As a stock, it would underrepresent the entry of temporary immigrants who will have returned or emigrated to third countries. If the returnees are different from the stayers in their experience of the legal status, the estimate that is based on only stayers may over- or under-estimate the effect of legality. Thus, some researchers have used data from immigrants collected in the home countries.[4]

In this study, I use the survey dataset provided by the Mexican Migration Project (MMP). It is an annual, randomized survey of Mexican families, conducted in Mexico, and focuses on migrant sending states. The advantage of the MMP data over the above-mentioned sources of commonly used data is its direct identification of immigrants' legal status. The sampling design of the dataset indicates that the dataset is more representative of Mexican immigrants found among the Mexican population compared to the stock of immigrants in the U.S. This feature of the MMP dataset can be taken as an opportunity to elaborate on the behavior of return migrants, whereas research that is based solely on the immigrant stock in the U.S. would tend to undersample return migrants. About 58 percent of the immigrants in the data used for this analysis consists of temporary immigrants

[2] e.g., used by Lofstrom et al. (2013); Mukhopadhyay (2018)
[3] e.g., used by Kaushal (2006); Pan (2012); Lozano and Sorensen (2011)
[4] e.g., used by Lozano and Sorensen (2011)

who have already returned to Mexico, while the other 42 percent reported to be still residing and working in the U.S. at the time of the survey. Thus, in contrast to datasets collected in the U.S., the MMP survey allows for a comparative analysis of returnees and stayers. It also entails that the results would be more representative of the experience of temporary Mexican immigrants.

A shortfall of this dataset is its inability to capture permanent immigrants who move as a whole household, which tends to be applicable to permanent legal immigrants. Although the survey underrepresents whole household legal immigrants, the weakness is moderated by its capability to capture immigrants in the U.S. whose original household members remain in the origin community. This analysis uses the retrospective information provided on the household heads.

To recover the effect of legal documentation on immigrants' outcomes, I compare the outcomes for two types of stay in the U.S. - lawful permanent residence (LPR) and unauthorized stay. The analysis focuses on the years after the Immigration Reform and Control Act (IRCA) of 1986, an immigration reform that made a substantial shift in U.S. policy response to unauthorized immigration. I investigate immigrants' occupational and legal status in each year of their stay in the U.S. Then, I compare job mobility and immigrants' wages in the U.S.

A common difficulty encountered by researchers in their study of the effect of legality is that immigration status can suffer from a selection effect. Potential unobserved causes of different selection of legal and unauthorized immigrants are many. The U.S. has a legal immigration system based on family and employment ties to the U.S. Mexican immigrants tend to be admitted legally on family ties more frequently than immigrants from other countries (U.S. Department of Homeland Security, 2017a) Thus unauthorized immigrants may be those who do not have family ties in the U.S. If close relatives in the U.S. facilitate labor market outcomes beyond those the non-family network offers, it will be a cause for different selection. Similarly, unauthorized immigrants may have different motives to immigrate and different information sources than legal ones. For instance, those who intend to return within short time may decide on an unauthorized immigra-

tion instead of waiting for legal immigration approval. Individual characteristics of undocumented and legal immigrants differ.

Many of the previous studies use a large scale legalization as an exogenous change in the probability of legalization, to identify the effects. As the largest legalization program in the recent U.S. history, the IRCA provides a quasi-experimental setting for many causal studies of the legal status on labor market outcomes of immigrants (Amuedo-Dorantes et al., 2007; Kossoudji and Cobb-Clark, 2002; Rivera-Batiz, 1999). Kaushal (2006) used a more recent legalization program from 1997 for Central American immigrants. Orrenius et al. (2012) used the legalization of Chinese immigrants in 1992 to examine the effect of changing from a temporary immigrant status to a permanent legal one. To my best knowledge, studies by Lofstrom et al. (2013) and Mukhopadhyay (2018) are the only ones looking at immigrants obtaining legal status through conventional channels.

This paper's contribution to the literature is threefold. First, I focus on the effect of legal status on the occupational outcomes of immigrants, a topic that has been rarely studied systematically as opposed to studies on their wages. I give an indication of how much of the wage premium of legal status is due to occupational standing. Second, this analysis is different in that I do not use amnesty as a source of variation in legalization. Instead, I use the variation in the timing of receipt of legal status. Still, 55 percent of immigrants in the dataset reported receiving legal status through the IRCA amnesty. Thus I look separately at immigrants who have first immigrated after 1985, who were not eligible for amnesty under the IRCA. I take into account the selection effect by looking at within-individual change using fixed effects analysis. However, the fixed effects method has the downside of not being able to deal with heterogeneity that changes across time. In particular, if an individual's decision to legalize was affected by their labor market outcomes on an earlier trip, it would bias the estimates. The direction of the bias in the estimates would depend on how the decision to legalize is related to immigrant's earlier outcome. I attempt to separately verify the relationship between an individual's legalization and his earlier labor market outcome, to determine the nature of such changing heterogeneity and its effect on the estimates. Lastly, I analyze the effect

of legal status on returnees and stayers, something that has been overlooked in the literature. The effect of legal status appear to be different on these two groups. A differentiated analysis gives an indication of how the estimated effects would differ between samples obtained in the home and host countries.

Studying the effect of legality on immigrants' occupational status is important because occupational choices describe the opportunities and limitations faced by immigrants on the labor market on a different scale than their wage information. Second, occupational choices affect both the immigrants as well as the natives. In the two decades since 1990, about 1 million immigrants received legal permanent immigration permissions annually, of whom about half were newly arriving immigrants.[5] (U.S. Department of Homeland Security, 2017a) In the same period, an estimated 650,000 – 750,000 unauthorized immigrants were entering the U.S. every year (Figure 3.1) (Warren and Warren, 2013).[6] That is, for every 10 new legal immigrants 7 individuals were coming to the U.S. as unauthorized immigrants either through an unlawful entry or a visa overstay. On the demand side, the Bureau of Labor Statistics predicts that the composition of the labor force in the U.S. will change greatly in the next decade. The labor force of Hispanic and Asian origin is predicted to grow at an annual rate of 2.7 and 2.5 percent respectively over the decade to 2026 in contrast to the overall rate of 0.6 percent (Bureau of Labor Statistics, 2018). Health care and social assistance, leisure and hospitality and construction sectors, sectors where immigrants work in high numbers, are projected to grow faster than the average industry rate. Given the magnitude of the number of immigrants coming to the U.S., examining the consequences of legal and unauthorized status on immigrants choices and outcomes is important, since it allows policy makers and immigration researchers to evaluate the immigrants' effect on the native labor market.

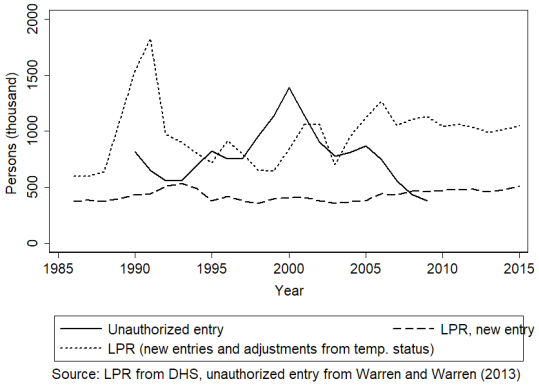
The results of the study indicate that the undocumented status leads to an occupational downgrading. In particular, about 4 percentage points of the wage premium due to the legal immigrant status can be explained by differences in oc-

[5]The other half were adjusted from the "non-immigrant" status.
[6]This includes unauthorized entrants as well as visa overstayers.

cupational standing. It increases to about 6 percentage points for immigrants in non-agricultural occupations. However, these should be considered as conservative estimates of the effect of documentation due to a selection problem discussed in detail below. Return migrants, who are likely to be overrepresented in the MMP, appear to benefit the least from legalization. The results also show that the undocumented status leads to lower job mobility and lower wages.

The paper is structured as follows. The next section presents a literature review on the topic of this study, followed by a brief overview of U.S. immigration policy and Mexican immigration to the U.S. Section 3 then describes the dataset and presents a descriptive analysis. Section 4 discusses the set-up of the empirical models to analyze immigrants' occupational outcomes and presents the estimation results. Section 5 and 6 presents the analysis of job mobility and wage outcomes respectively. Section 7 presents a discussion of main results. The conclusion is presented in Section 8.

FIGURE 3.1: LAWFUL AND UNAUTHORIZED ENTRIES



Source: LPR from DHS, unauthorized entry from Warren and Warren (2013)

3.2 Background

3.2.1 Literature Review

A review of the literature reveals that the undocumented status limits the occupational range, occupational mobility, and wages of immigrants. Census data of Latin American immigrants in California suggests that men experience some occupational upgrading after legalization, while women obtain more employment opportunities but not occupational upgrading (Pan, 2012). But this is the result of a descriptive analysis that groups occupations into 4 broad groups. Steigleder and Sparber (2017) find that immigrant men legalized by the IRCA tended to move from works requiring manual skills into those requiring more communication skills. Kossoudji and Cobb-Clark (2002) and Barcellos (2010) report a move in legalized immigrants away from traditionally most common immigrant jobs. Lozano and Sorensen (2011) analyzes the occupational outcomes of the pre- and post-IRCA immigrant arrivals in the Census using the average occupational wages of natives in the Census. They find an increase in the occupational wages of the pre-IRCA with respect to the post-IRCA immigrants who were estimated to have entered unauthorized. They conclude that 19 of the 20 log point increase in the wages of these immigrants were due to occupational upgrading. Using data from recent recipients of the LPR status and measuring occupational wage by the median occupational wages of foreign-born individuals in the Census, Lofstrom et al. (2013) find that legalization improved occupational standing of visa overstayers by 6.4 percent and did not improve occupational standing of unauthorized border-crossers, all of whom legalized in the year 2003. Lofstrom et al. (2013) also find that wages did not increase after legalization for unauthorized workers. They conclude that the short observation period and labor market changes might have contributed to the discrepancy of the results from earlier literature.

Other studies show that legalized immigrants earn higher wages. For instance, Barcellos (2010), Pan (2012) and Lozano and Sorensen (2011) use regression discontinuity and differences-in-differences approaches to compare immigrants who

have different likelihoods of becoming legalized under the IRCA. While Barcellos (2010) and Pan (2012) find a 4-5 percent increase in the wages for the cohort of all immigrants arriving before the eligibility cutoff date for the IRCA legalization, Steigleder and Sparber (2017) and Lozano and Sorensen (2011) find 4-8 percent and 20 percent increases respectively in the wages of the unauthorized cohort arriving before the cutoff date. After analyzing a sample of immigrant men legalized by the IRCA, Kossoudji and Cobb-Clark (2002) report a legalization benefit of 14-24 percent increase in wages. Legalized immigrants also experience a higher wage growth (Rivera-Batiz, 1999). While the literature on the effect of the IRCA legalization shows positive effects, studies of the effect of legal status using more recent cases reach different results. Mukhopadhyay (2018), comparing the IRCA-legalized immigrants with immigrants receiving legal status in 2003, conclude that the wage effect of a recent legal status is 18-26 percent higher than the IRCA legalization effect. However, Kaushal (2006) finds that the large scale legalization of Central American immigrants in 1997 leads to a 3-4 percent increase in their wages. Lofstrom et al. (2013) find no effect on the wages of recent legal immigrants.

While legalization leads to increased wages and broader occupational choices, its effect on labor supply appears to be negligible or negative. A sample of legalized men and women in the Legalized Population Survey were less likely to be employed after the IRCA, suggesting that immigrants' reservation wage may have increased (Amuedo-Dorantes et al., 2007). Kaushal (2006) and Pan (2012) also find that employment of immigrants did not increase after legalization. However, the effect of legalization from a temporary status to the LPR shows a positive effect of legal permanent status on employment as well as wages (Orrenius et al., 2012).

Studies on the effects of legal status on the labor market outcomes of immigrants in countries other than the U.S. appear to be rare. Exceptions are the studies by Fasani (2015) and Devillanova et al. (2017) who find that application for amnesty already increases the employment and wages of unauthorized immigrants in Italy. In a study of the effect of citizenship on legal immigrants in Germany, Gathmann and Keller (2017) find a positive effect on wages and wage growth. Hartog and

Zorlu (1999) document the characteristics of undocumented immigrants, the type of work that they do, and effect of increased enforcement in a study on textile workers in the Netherlands.

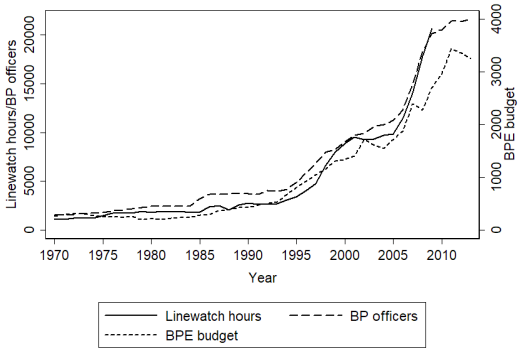
Other effects of legal status have been studied as well. Researchers have studied the effects of documentation on immigrants' consumption in the host country (Dustmann et al., 2017), education and training decisions (Greenman and Hall, 2013; Méndez et al., 2016; Mukhopadhyay, 2017), remittances (Amuedo-Dorantes and Mazzolari, 2010), criminal activities (Baker, 2015; Mastrobuoni and Pinotti, 2015), health and health insurance (Campbell et al., 2014), English speaking ability (Pan, 2012), and exposure to occupational hazard (Hall and Greenman, 2015). Fasani (2015) offers a detailed literature review of the effect of legal status on immigrant outcomes.

3.2.2 The U.S. immigration Policy After the IRCA

Enacted in 1986, the IRCA legalized about 2.7 million undocumented immigrants, more than 70 percent of whom were immigrants from Mexico (Baker, 2010). At the same time, the IRCA was the first of a set of restrictive policies implemented in the U.S. against undocumented immigrants. It increased the funding for Border Patrol by 82 percent and increased border enforcement staff by 50 percent. It introduced employer sanctions for the hiring of undocumented immigrants. This was followed by a drastic increase in border enforcement in the 1990's and the 2000's (Figure 3.2). In 1996, an immigration reform was implemented that strengthened border control and internal enforcement measures against undocumented immigrants.[7] It increased the penalties for undocumented entry and stay, introduced expedited removal for arriving immigrants, and added new grounds for inadmissibility. Since 2000, new technologies were implemented to strengthen enforcement. An electronic system was introduced to check immigrants' admissibility at the border and a mandatory electronic verification system was introduced for employers in its hiring of new workers.

[7]Illegal Immigration Reform and Immigrant Responsibility Act.

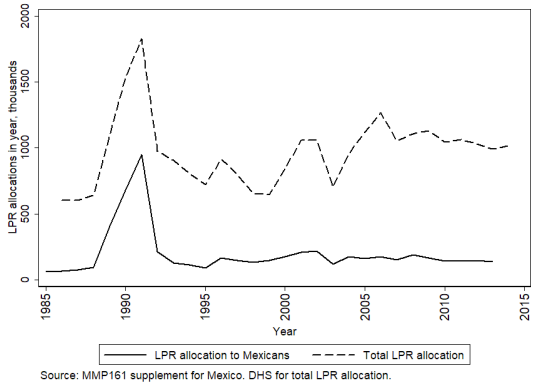
FIGURE 3.2: ENFORCEMENT AGAINST UNAUTHORIZED IMMIGRATION



Linewatch hours in thousands. BPE budget in thousand USD, base year is 2010.
Source: MMP161 Supplement

Excluding the IRCA legalized immigrants, the allocation of LPR status to immigrants of Mexican origin was relatively stable over the years (Figure 3.3). The majority of legalizations due to the IRCA happened in during 1989-1992 due to the requirements placed on applicants to obtain the LPR. In major legal reform for legal immigrants, the public benefits available to incoming legal immigrants was reduced in 1996.[8]

FIGURE 3.3: ALLOCATION OF THE LPR STATUS



Source: MMP161 supplement for Mexico. DHS for total LPR allocation.

[8]Personal Responsibility and Work Opportunity Reconciliation Act of 1996.

3.2.3 Mexican Immigrants in the U.S.

In 2014, 13 percent of the U.S. population constituted of immigrants, or foreign born residents (Pew, 2015).[9] About a quarter, or 11.1 million, of the immigrants in the U.S. are unauthorized to stay and a similar proportion, or 11.7 million, are lawful permanent residents.[10]

Mexico is the single largest source country of immigrants in the U.S. comprising 27.7 percent (11.7 million) of the immigrant population in the U.S. in 2014 (Pew, 2015). The age distribution of Mexican immigrants in the U.S. reveals that, compared to the U.S. population, they are more often of working age: 89 percent of Mexican immigrants are of age 18-68 compared to 83.8 percent for the overall immigrant population and 63.8 percent for the U.S.-born (Pew, 2015).[11] Mexican immigrants are more likely to be in the labor force (68.8 percent) and less likely to be unemployed (6.4 percent) than the U.S.-born (62.5 and 7.4 percent respectively). The median age of a Mexican migrant in the U.S. is 40 years for males and 41 years for females, indicating that Mexican immigrants travel to the U.S. in their early 20's. Median years of stay for Mexican migrants in the 2014 survey is 16-20 years, same as that for the overall immigrant population. 79.4 percent of Mexican immigrants have been in the U.S. for more than 10 years. (Pew, 2015).

Among the new legal immigrants, Mexicans represent a sizable group. In 2015, 15 percent of the total LPR recipients were immigrants from Mexico, most of whom received the permit as immediate family members of U.S. citizens. In the 15 years since 2000, 2.6 million Mexicans became legal permanent residents of the U.S. (USDHS, 2017).

A significant proportion of Mexican immigrants in the U.S. are unauthorized immigrants. About half (49.6 percent) of the Mexican-born population in the U.S. consists of unauthorized migrants. Mexican unauthorized immigrants constituted

[9]The number of immigrants reported includes unauthorized immigrants, but does not include temporary stayers, or non-immigrants.

[10]Another 19.0 million, or 43.6 percent, are naturalized citizens.

[11]This is in part due to the second generation of immigrants being accounted as U.S.-born.

slightly more than half (52 percent) of the unauthorized migrants in the U.S. in 2014.[12] Mexican unauthorized entries stood at about 500,000 per year in the first decade of 2000 with 150,000 per year between 2007 and 2009 (Passel and Cohn, 2010). Compared to the other unauthorized immigrant groups, Mexicans stay longer in the U.S. The share of unauthorized immigrants who have stayed in the U.S. for longer than 10 years by 2014 is 78 percent for Mexican and 52 percent for other immigrants. Thus, the duration of stay for unauthorized and other Mexican immigrants appears to be the same when I consider the share of those who are staying in the U.S. for more than 10 years.

3.3 Data and Descriptive Analysis

3.3.1 Mexican Migration Project

The data for this analysis comes from the survey dataset provided by the Mexican Migration Project (MMP161), a collaborative project of researchers from the University of Guadalajara and Princeton University.[13] The annual survey is collected since 1982 and represents 161 communities in 24 states in Mexico. It provides individual level data on members of about 200 households that are randomly chosen in each community. The communities are chosen to represent those that have positive out-migration rates. Communities include villages, towns and metropolitan areas. Although each community is surveyed once, retrospective life histories of individuals are obtained. In addition to the socioeconomic characteristics of the household and demographic information on each member, the survey collects information on the life history of the household head including work history in the U.S.

The interviews for the survey take place in the winter, when seasonal immigrants

[12]The number of Mexican unauthorized immigrants reported by Pew (5.9 million in 2012) are lower than that reported by the latest U.S. Department of Homeland Security statistics by about 1 million (6.9 million in 2012) (Passel and Cohn, 2016; Baker and Rytina, 2013).

[13]The MMP161 database and codebook are available from mmp.opr.princeton.edu.

tend to return home. For each of the randomly chosen household from the community, the life history of the household head is obtained from the present household head or from the spouse if the head of the household is on a migration trip or is otherwise absent.[14] While this design is intended to ensure the quality of collected information, it results in missing those immigrants who move as a whole household. This weakness of the dataset is mitigated by the addition of a sample of out-migrants from the community who are located and interviewed in the U.S. Information about the out-migrants and households located in U.S. originate from the households interviewed in Mexico. In the sample of household heads used for the present analysis, 27 percent was interviewed in the U.S. and the rest in Mexico.

Since the communities in the sample are not randomly chosen, the sample is representative only of the communities surveyed. However, comparisons of the dataset with a nationally representative sample of persons with U.S. migration experience from the Mexico's National Survey of Population Dynamics (ENADID) indicate that, despite being geographically not representative, the migration behaviors and characteristics of the MMP sample of immigrants have a similar distribution to that of ENADID (Durand and Massey, 2004b). Hanson (2006) has compared the MMP sample of migrants to Mexican immigrants in the U.S. Census of Population and Housing. He concluded that the non-seasonal immigrants in the MMP sample are similar in individual characteristics to the Mexican immigrants in the U.S. Census, while the seasonal immigrants in the MMP sample - those who reside in the U.S. but return to Mexico in the winter months - are different from the permanent immigrants in the Census. Thus, the MMP sample is biased toward temporary immigrants who return to Mexico and the results need to be interpreted as such.

Although problems can arise in the quality of the responses for retrospective surveys such as the MMP, the comparison of the characteristics of the MMP sample, the sample of immigrants in ENADID and the U.S. Census indicates that the problem of false representation is limited. The refusal rate of respondents for the

[14] If the spouse does not have sufficient information on the lifetime history, the spouse is deemed as the household head (Mexican Migration Project and Latin American Migration Project, 2012).

survey in the 81 communities surveyed from 1982 to 2000 was quite low at 4.7 percent on average (Durand and Massey, 2004b).

For this research, I use the sample of male household heads, who have provided their life-time work history. I use the sample of immigrants who were working or looking for work in the U.S. for at least 1 month between the years 1987 and 2014, at the age between 15 and 65. A trip to the U.S. is defined as a migratory stay if it involves work, search for work, or a reasonably stable residence in the U.S. (Mexican Migration Project and Latin American Migration Project, 2012). Thus, a visit to the U.S. for tourism or a family visit purpose is not counted as a migratory trip for the purpose of this study. By definition, a trip is deemed concluded if the immigrant reports permanent return or a temporary return, where the subsequent trips to the U.S. involve a change of job or a change of residence or if he works in Mexico before his subsequent trip to the U.S. Thus, a brief return during a stay in the U.S. is not considered as the end of the trip. An immigrant is recorded as "returnee" if his last trip has concluded. In contrast, an immigrant is still on his last trip (i.e., "stayer") if he reported that his last trip has not yet concluded. I take the person-years in the U.S. with an immigrant's legal status that is either a legal permanent resident (LPR) or an unauthorized immigrant. This excludes contract workers, and visitors. Only communities with at least one legal immigrant and at least one unauthorized immigrant were included in the analysis.

Table 3.1: Descriptive statistics

Panel A. Sample of individuals	**Total**	
Sample size, persons	3153	
Household surveyed in the U.S., %	27	
Persons undocumented throughout observation	1681 (53 %)	
Persons legal throughout observation	933 (30 %)	
Persons changed status to legal	539 (17 %)	
Persons entered undocumented on first trip, %	86	
Persons entered as LPR on first trip, %	7.3	
Persons changed occupation, %	28.5	
Persons changed occupation and status, % in legalized after 1987	43.2	
Returned to Mexico, % in unauthorized persons	69	
Returned to Mexico, % in legalized and legal persons	45	
Legalized by IRCA, % in legalized and legal persons[1]	55	
Year of first trip, median (range)	1985 (1928-2013)	
Observation period, range	1987-2014	
Total number of trips, median (range)	2 (1-44)	
Panel B. Sample in person-years	**Undocumented**	**LPR**
Sample size	10,571	10,555
Individual characteristics (within PY):		
Age, mean	31.3	37.9***
Years of education, mean	6.6	6.2***
Married, % in PY	59	81
Total number of children, mean	2.2	3.0***
US cumulative experience, mean years	6.6	14.0***
Total number of trips, median	2	4
State: California, % in PY	48	56
State: New York, % in PY	11	4
State: Illinois, % in PY	8	9
State: Texas, % in PY	8	9

[1] Sponsor information available for surveys after 1998.
Note: *** t-test for means significant at 1% level.
Percentages are of the total number of individuals in the sample, unless otherwise noted.

After dropping 820 individuals with only 1 person-year observation in the U.S., I obtain a sample of 3153 immigrants and 21,126 person-year observations. Thus the main sample consists of immigrants with trips that are longer than 1 year and those who have multiple trips some of which are short trips of 12 months or less.[15] The descriptive statistics of the migrant sample used in the data are

[15]The characteristics of the 820 individuals who are dropped from the sample due to the lack of observations are shown in Table 3.14. These individuals (Column 1) are compared to 1324 circular immigrants with short, but multiple trips (Column 2) and 2044 individuals who have at least 1 longer trips (Column 3). The sample of dropped individuals appear to be those

reported in Table 3.1. Of the sample of immigrants, 85.5 percent have entered the U.S. undocumented on their first trip, 7.3 percent as legal permanent residents, and others under temporary contracts or other status. The immigrants' first entry year to the U.S. range from 1928-2013. During the observations years 17 percent, or 539 individuals, changed their status from unauthorized to LPR, 30 percent remained LPR and 53 percent remained unauthorized. During the observation years 28.5 percent of individuals changed their occupation overall and 43 percent of individuals who changed status changed their occupation. By the time of the survey, 69 percent of unauthorized persons and 45 percent of legalized and legal persons had returned to Mexico.

Descriptive statistics show that legal and unauthorized immigrants are different. Legal migrants tend to be older, married, and have more children. Legal immigrants have more frequent trips to the U.S. and longer total duration of stay in the U.S. Both legal and unauthorized immigrants in the dataset have a median of 6 years education. About half of immigrants work in California. A significant share of both legal and unauthorized immigrants work in the states New York, Illinois or Texas.

3.3.2 Occupational Wages

For the analysis of occupational status I use the reported occupations of Mexican immigrants in each person-year. Individual occupations in the MMP161 dataset are categorized using the 3-digit Mexican Classification of Occupations (CMO). The CMO features 134 3-digit occupational categories in 18 broad categories.[16] The occupations in the classification were matched with one or more corresponding occupations in the U.S., to link them with the state-level occupational wages in

individuals who are more similar to circular immigrants in the main dataset that have short, but circular trips to the U.S. The results of OLS analysis that includes individuals with only 1 person-year stay are very similar to that without as shown in Table 3.15 in the Appendix 3.A.2.

[16]CMO occupational categories 214 (Small and medium-sized factory owners) and 215 (Small and medium-sized service establishment owners) were dropped from the analysis as these were occupational categories added by the MMP and did not have corresponding occupations in the SOC.

the U.S.

Table 3.2: Major occupational groups, %

Major occupational group	Mean wage, USD	**Undocumented**	**LPR**
Agriculture, husbandry, forestry/fishery workers	21,202	16.8	28.0
Manufacturing and repair, supervisors	58,786		2.2
Manufacturing and repair, skilled workers	33,527	31.8	21.8
Manufacturing and repair heavy equipment operators	44,329		1.5
Manufacturing and repair, unskilled workers	25,178	18.1	19.0
Transportation workers	27,986	2.3	3.3
Administrative and support workers	27,128	1.0	1.7
Sales workers	54,025	5.0	5.5
Personal service workers in establishments	21,235	22.8	14.2
Other occupational groups		3.3	2.8

Note: Table shows major occupational groups with at least 1% representation within unauthorized and legal immigrants, by person-year. Mean wage shows the mean of the occupational (median) wages across the sample. Base year for the wage is 2010.

For the U.S. wages, I assign the state-level occupational median annual wages reported by the 2010 Occupational Employment Statistics (OES) Survey from the U.S. Bureau of Labor Statistics.[17] The occupational codes in the OES are reported in the 2010 Standard Occupational Classification (SOC) system. Using a crosswalk system provided by the National Institute of Statistics and Geography (INEGI), each of the CMO occupations was matched with one or more SOC occupations.[18] The state-level median annual wages for each SOC occupation were then weighted by the occupational employment number in the state and combined to create the median annual wage for each occupation reported in the MMP dataset. The median annual wage assigned to each occupation in a person-year does not differ by the immigrants' legal status.

The distribution of major and detailed occupational groups shows that legal immigrants work in wider range of occupations (Tables and 3.2 and 3.13). Table 3.2 presents the major occupational groups of immigrants. About one third of the legal immigrants work in the agriculture, husbandry, forestry and fishery sectors in

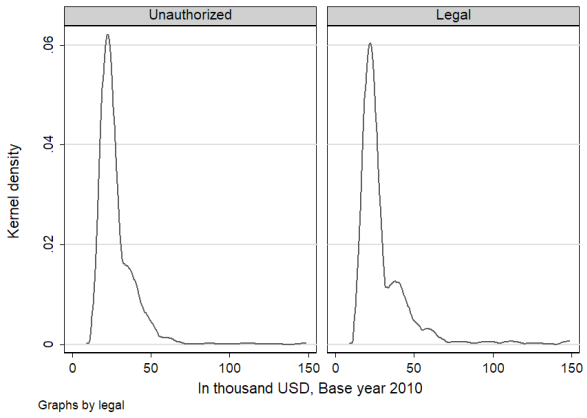
[17] I use annual, rather than hourly, wages as OES reports only annual wages for some occupations including entertainment workers and teachers.

[18] The crosswalk system can be found at `http://www.inegi.org.mx/est/contenidos/proyectos/aspectosmetodologicos/clasificadoresycatalogos/doc/sinco_tablas_comparativas.xls`

contrast to less than one fifth of the unauthorized immigrants. Higher proportion of unauthorized immigrants work in skilled manufacturing and repair work while higher proportion of legal immigrants work as manufacturing and repair supervisors. Unauthorized workers work more in establishments as service workers, such as doormen, concierges, elevator operators, bellboys, cleaning workers, gardeners, and dishwashers.

The occupational wage distributions by legal status are presented in Figure 3.4. Differentiation by year and legal status indicates that the occupational difference between legal and unauthorized immigrants is growing over the years since the IRCA (left panel of Figure 3.5). The right panel of figure 3.5 shows that the trend in difference remains when I exclude the legal immigrants who were legal throughout the observation period. Thus, the increasing difference between the occupational status of immigrants appear to be due to the changing effect of legal status and not to a changing entry of legal and unauthorized immigrants.

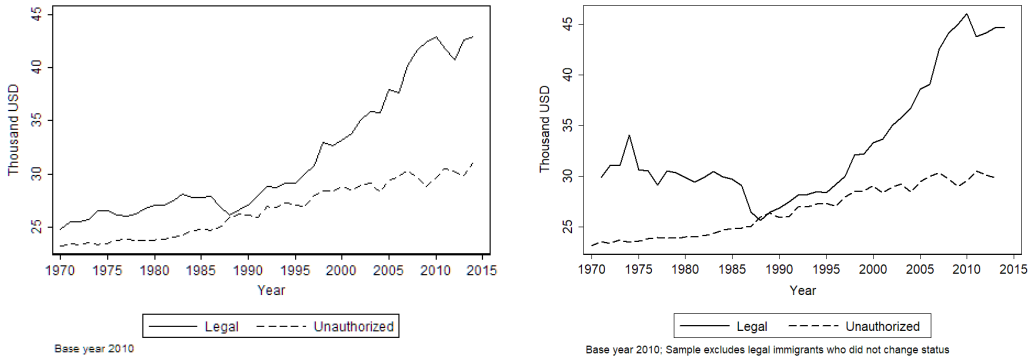
FIGURE 3.4: OCCUPATIONAL ANNUAL REAL WAGE DISTRIBUTION BY LEGAL STATUS



3.4 Occupational Status

This section begins the empirical analysis of legal status and labor market outcomes of immigrants. It covers the main topic, the effect of legal status on the

FIGURE 3.5: OCCUPATIONAL ANNUAL REAL WAGE BY YEAR AND LEGAL STATUS



occupational outcomes of immigrants. First, I introduce the main empirical strategy and present the estimation results. This is followed by a discussion of seasonal agricultural work and whether it affects the estimates. Subsequently, I discuss possible issues of endogeneity and attempt to quantify their effect. The last subsection analyzes how return behavior is affected by labor market outcomes. After concluding the analysis of occupational standing, I explore how legalization affects job mobility and hourly wages in the sections to come.

3.4.1 Empirical Strategy

To analyze the occupational standing of legal and unauthorized immigrants, their occupational choices are modeled as follows:

$$y_{it} = \delta^o D_{it} + X^o_{it}\beta^o + \alpha^o_i + \varepsilon^o_{it} \tag{3.1}$$

where the dependent variable y_{it} is the log occupational wage of immigrant i in year t. By assigning the national (log) median wage for each occupation, I attempt to separate the effect of occupational standing from the wage effects of legal status. The main independent variable of interest, D_{it}, is an indicator for legal status. Control variables in X^o_{it} include age, schooling in years, marital status, number of children and total experience in the U.S. up to the person-year. Apart from the total immigration experience, circularity of immigration may also affect labor

market outcomes. When a legal or unauthorized immigrant's stay in the U.S. is frequently interrupted by a return to Mexico this can affect their occupational outcomes negatively. This effect of circularity of immigration may be confounded with that of the legal status when legality is correlated with the frequency of returns. For instance, as the descriptive analysis of the sample showed, legal immigrants appear to take more frequent trips. Thus, the first year of a new trip is indicated by a dummy variable to control for the circularity of immigration experience. Year dummies are included to capture the annual changes in the demand and supply factors in the labor market. Finally, origin community and destination state dummies are included to control for the heterogeneity in the sending and receiving communities.

I denote by α_i^o further unobserved heterogeneity across individuals that affects their selection into legal and unauthorized immigration. For example, the existence of a legally immigrated family member may affect both their legalization probability and, independently, their labor market outcomes. The presence of these individual-specific unobserved selection factors would naturally bias the estimates of the effect of legal status. Fortunately, the panel structure of the dataset means that the time-invariant selection factors can be addressed by within-individual fixed effects estimation. Using the sample of men with at least 2 person-year stays in the U.S., I estimate the effect of legal status by the fixed effects method. The resulting analysis compares the occupational outcomes of immigrants who change their legal status to those who do not change status after 1987, including both unauthorized and legal immigrants. This method does not allow me to handle time-varying unobserved heterogeneity, which I attempt to address in a subsequent analysis.[19]

In the forthcoming discussion, I refer to immigrants who changed their status during the observations years as legalized as they have all legalized from the unau-

[19] An instrumental variable analysis would be helpful for this issue. Thus, I have attempted IV analysis with two different instrumental variables - the legal status of immigrants' parents (in a fixed effect setting) and rainfall in Mexico. However, both were unsuccessful, due to a lack of detailed data. There was insufficient variation in the legal status of parents and little correlation in rainfall and undocumented immigration after the mid 1990's.

thorized to legal status. The identification of the effect of legalization is based on these legalized immigrants. The legal immigrants who did not change status during the observations period are referred to solely as legal immigrants. These immigrants may have been legalized earlier than 1987 from another status or have entered the U.S. as legal permanent immigrants on their first trip. Unauthorized immigrants who did not legalize are denoted as unauthorized immigrants.

3.4.2 Estimation Results

The parameter estimates for the empirical model are presented in Table 3.3. A naive OLS regression of the occupational wage without individual-specific characteristics shows a 6 percent difference in the occupational median wages between legal and unauthorized workers (Column 1). However, a large part of the difference is due to differences in personal characteristics between legal and unauthorized immigrants (Column 2). It indicates a 1.5 percent difference due to legal status when personal characteristics are taken into account. Columns (3)-(6) show the result of within-individual fixed effects estimation. Column (3) shows the estimates of the main specification. The within-individual estimate for the effect of legal status is 4.2 percent. It indicates that the unobserved individual characteristics that improve occupational outcomes are negatively correlated with legal status, leading to a downward bias in the OLS estimate. It suggests that legalized immigrants come from the lower tail of the occupational outcome distribution. That is, those individuals who would benefit the most from legal status in terms of occupational upgrading choose to legalize when the opportunity arises.

The estimates on the control variables indicate that marriage, having children, and longer experience in the U.S. all raise occupational outcomes. A 10 year stay in the U.S. is associated with an increase in occupational wage by 9 percent. On the other hand, age is negatively related with occupational outcomes, although the effect is smaller in magnitude than that for experience. A 10 year increase for a 40 year old immigrant's age is associated with a 7.5 percent decrease in the occupational outcomes. Circularity of trips appear to have no effect on occupational outcomes,

once I control for individual heterogeneity by fixed effect.

Next, I interact the legal status indicator with a linear trend to determine how the effect of legal documentation is changing over the years. The results in Column (4) point to an increasing trend over the years, consistent with the descriptive analysis. Each decade after the IRCA is associated with a 4.0 percent increase in the effect of legal status on occupational wage.

Table 3.3: Occupation-based wage regression

Dependent variable = (log) Occupational median wage						
	OLS		Within-individual			
	(1)	(2)	(3)	(4)	(5)	(6)
Legal	0.059***	0.015**	0.041***	0.014	0.004	0.045***
	(0.006)	(0.006)	(0.009)	(0.009)	(0.009)	(0.010)
Legal * Linear trend				0.039***		
				(0.008)		
Legal * First trip after 1985					0.080***	
					(0.017)	
Age/10		0.077***	0.018	0.009	0.014	-0.012
		(0.015)	(0.023)	(0.024)	(0.023)	(0.028)
Age/10 squared		-0.012***	-0.009***	-0.010***	-0.008***	-0.005**
		(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Education in years		0.000				
		(0.002)				
Education squared		0.001***				
		(0.000)				
Married during PY		0.039***	0.032***	0.029***	0.030***	0.040***
		(0.006)	(0.007)	(0.007)	(0.007)	(0.009)
Children		-0.006***	0.012***	0.012***	0.012***	0.017***
		(0.001)	(0.003)	(0.003)	(0.003)	(0.004)
Experience in US, in decade		0.034***	0.086***	0.097***	0.081***	0.080***
		(0.012)	(0.016)	(0.016)	(0.016)	(0.021)
Experience in US, squared		0.009**	0.002	-0.003	0.003	0.003
		(0.004)	(0.003)	(0.003)	(0.003)	(0.004)
New trip		-0.031***	-0.001	-0.002	-0.001	-0.001
		(0.006)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	21126	21126	21126	21126	21126	14140
R^2	0.199	0.226	0.063	0.066	0.065	0.080

Standard errors clustered within community-year are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Note: Linear trend is equal to (Year-1986)/10. All regressions include separate dummies for year, community and work states in the US and a constant. Column (6) excludes the sample of migrants who are legal throughout the observation period.

Among the legal immigrants who were asked about the category under which they received legal documentation, 55 percent have reported being legalized under the

IRCA.[20] Individuals legalized under the one-time amnesty IRCA and individuals legalized under ordinary conditions may have been differently affected, as found by Kossoudji and Cobb-Clark (2002). I verify this result by interacting the legal status indicator with information on whether individual was legalized by the IRCA. In the absence of sponsorship information for all immigrants in the dataset, I denote individuals whose first trip occurred in and before 1984 as legalized under the IRCA.[21] The estimates show that legalization under the IRCA had no effect on occupational outcomes while legalization under ordinary terms leads to a 8.3 percent increase in occupational wages. This result is consistent with the literature on the effect of the post-IRCA legalizaton on immigrants' wages (Kossoudji and Cobb-Clark, 2002; Mukhopadhyay, 2018).

The identification of the effect of legal status is based on the sample of immigrants who legalized from the unauthorized to legal status. Since this sample might be significantly different from those who enter the U.S. legally, a robustness analysis was done by excluding all immigrants who have a legal resident status throughout the observation period. The results shown in Column (6) show that the estimated effect of legal status is slightly larger than the main result at 4.6 percent and significant at the 1 percent level.

3.4.3 Non-agricultural Immigrants

Seasonal agricultural work is a common job for many Mexican immigrants. The agricultural work I refer to in this section applies to the occupation that is associated with cultivation of crops, but not with animal husbandry, fishery, hunting or forestry. In the dataset, 35 percent of immigrants, or 1096 individuals, have reported working in agriculture at some point during their stay in the U.S. Only 40 percent of them remained unauthorized throughout the observation period in

[20]The category of legal admission was asked for surveys from 1998.

[21]Under the IRCA unauthorized immigrants who continuously resided in the since 1982 and those who have worked for 3 consecutive years in agricultural work prior to 1986 were eligible for legalization. Thus those arriving for their first trip in or after 1985 would not be eligible for legalization under the IRCA.

comparison with 60 percent in other immigrants, while another 22 percent legalized during the time in comparison with 15 percent in others (see Tables 3.4 and 3.13). Thus, agricultural work appears to be more common among legal than unauthorized immigrants. Furthermore, working in agriculture at one point is associated more frequently with legalization.

Table 3.4: Agricultural and non-agricultural immigrants

All immigrants:	Agricultural[1]	Non-agricultural[2]	
Sample size	1096	2057	
Changed legal status after 1987, %	21.5	14.7	
Unauthorized and no change in status, %	40.1	60.4	
Occupational median wage, USD	23,867	31,044	
Occupational median wage for agricultural work, USD	20,293		
Occupational median wage for non-agricultural work, USD	30,767		
Agricultural immigrants[1]:	Unauthorized[3]	Legalized	Legal[4]
Occupational median wage, USD	23,651	23,914	23,994
Work in agriculture, % in PY	62.1	56.2	62.1
Work in agriculture before legalization, % in PY		61.1	
Work in agriculture after legalization, % in PY		54.8	

[1] Worked in agriculture for at least in one person-year. [2] Never worked in agriculture.
[3] Unauthorized and did not change status after 1987. [4] Legal and did not change status after 1987.
Base year of wage is 2010.

While a common occupation among immigrants, agricultural work is valued significantly less than other occupations. For instance, the median occupational wage among agricultural immigrants in various states is 20,293 USD while that for all other work is 30,767 USD, a difference of 52 percent.[22] As a result, immigrants who work in agriculture for at least a part of their stay earn significantly less than those who never work in agriculture. Among the immigrants who worked in agriculture in some years, about 60 percent of their person-year is spent in agricultural work. Among those who first entered legally or received their legal status before 1987, the prevalence of agricultural work appears to be as much as in unauthorized workers. However, it appears that agricultural immigrants who legalized after 1987 work less in agriculture after legalization (55 percent of PY after legalization versus 61 percent before legalization). Thus, legalized agricul-

[22]The base year is 2010.

tural immigrants tend to choose more diverse jobs although a larger percentage of them still works in agricultural jobs rather than in non-agricultural jobs. This is indicative of increasing diversification in the types of jobs that immigrants do after legalization.

Due to the low wage and the relative frequency of agricultural workers among legal immigrants, the estimate of the effect of legal documentation may be underestimated for non-agricultural immigrants. Thus, I estimate the effect of legal status excluding all immigrants who worked in agriculture at one point during their stay. The results presented in Table 3.5 show that indeed the effect is larger for non-agricultural immigrants. The average effect of legal status is 5.8 percent, while the effect for the post-IRCA immigrants is 11.6 percent.

Table 3.5: Occupation-based wage regression for non-agricultural immigrants

Dependent variable = (log) Occupational median wage						
			Within-individual			
	(1)		(2)		(3)	
Legal	0.056***	(0.012)	0.021	(0.013)	-0.001	(0.012)
Legal * Linear trend			0.043***	(0.011)		
Legal * First trip after 1985					0.110***	(0.022)
Age/10	0.007	(0.032)	0.003	(0.032)	0.004	(0.032)
Age/10 squared	-0.007**	(0.003)	-0.007**	(0.003)	-0.006*	(0.003)
Married during PY	0.035***	(0.009)	0.032***	(0.009)	0.033***	(0.009)
Children	0.020***	(0.004)	0.020***	(0.004)	0.019***	(0.004)
Experience in US, in decade	0.065***	(0.022)	0.075***	(0.022)	0.057**	(0.022)
Experience in US squared	0.007*	(0.004)	0.000	(0.004)	0.009**	(0.004)
New trip	0.004	(0.005)	0.003	(0.005)	0.005	(0.005)
Observations	14183		14183		14183	
R^2-within	0.065		0.067		0.068	

Standard errors clustered within community-year are in parentheses. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Note: Linear trend is equal to (Year-1986)/10. All regressions include separate dummies for year, community and work states in the US and a constant.

3.4.4 Endogeneity Due to the Choice of Legalization

A weakness of the fixed effects method is its inability in addressing any unobserved individual heterogeneity that changes over time. A time-varying unobservable in the wage regression of legal status can be one of two types. First, legalization

can be endogenous in the wage regression as a result of which the estimates can be biased. It happens if the labor market outcome at the outset of a trip is the cause of a legalization. Second, a third unobservable might be the common cause of both legalization and a change in occupational choice. A case of such a third factor would be the legalization of another close family member, as this would open the possibility for an immigrant to legalize and affect their occupational outcomes. I address both possibilities in this section.

To evaluate the extent of the link between the first labor market outcome and later legalization, I use a discrete time duration model. I use a setup for analyzing event histories described by Allison (1982) and Jenkins (1995).[23] In this approach, the legalization decision of each individual in the dataset is viewed as a sequence of binary decisions along time. Time is assumed to proceed in discrete intervals. Observation of an individual either ends in legalization or is right-censored by the survey or when the observation period ends. Thus, individuals are observed for varying lengths of time depending on whether the spell ends in transition or censoring. The observations are set up so that each individual contributes a discrete number of observations equal to the duration of observation. The empirical hazard rate for duration s is calculated based on the surviving population at time s.

The advantage of this approach is that it is relatively simple to use when the duration of a completed or uncompleted spell is known at the time of observation but the spell may have began before the observation period started, as in this case. For instance, suppose that individual i's first migration to the U.S. occurred at a known year s_i^0 and the individual stays continuously in the U.S. since then. However, observation starts at year t_0 where $t_0 > s_i^0$. Individual i's spell duration in year t_0 is then equal to $S_i^0 = t_0 - s_i^0$. At another time t, the individual's duration is equal to $S_i = t - s_i^0$. The empirical hazard rate, or the conditional probability of an individual's legalization at duration s conditional on not legalizing until

[23] Used in, for instance, Bover et al. (2002) and Henley (1998).

duration s (and other conditioning variables), is modeled as follows.

$$P(S_i = s|S_i >= s, y_{1i}, X_{it}^l) = P(D_{it} = 1|S_i >= s, y_{1i}, X_{it}^l) = G(\xi_s^l, y_{1i}, X_{it}^l) \tag{3.2}$$

where S_i is the duration of an individual's spell (at year t) measured as total experience in the U.S. until the person-year (for a continuous stay in the U.S., $t = s_i^0 + s$) and G signifies the functional form of the probability. D_{it} is an indicator for individual's legal status in year t. Duration indicator ξ_s^l is a dummy variable for duration s. Duration dependence for legalization is thus flexibly specified for the first 10 years of U.S. experience and is assumed to be constant after the 10-th year. The main independent variable y_{1i} is immigrant i's first main occupation on their first trip. The first occupation on an immigrant's first trip is again assigned its median (log) occupational wage in the year 2010. Other control variables are years of schooling, age, marital status, number of children in the person-year, and an indicator for agricultural work as the first occupation. Also included are origin community and destination state dummies, in addition to year dummies for the observation year. The model is estimated by the probit regression.

The results presented in Column (1) of Table 3.6 are based on the full sample of immigrants, after excluding those who are missing occupational information or did not work during their first trip. In this sample the status of the first main occupation on their first trip is positively related with their legal status after 1987. However, inclusion of legal entrants may bias the estimated effect of first occupation upward as legal entrants would be better situated in the job market from the start. In Column (2), I drop from the sample those who were legal at the entry of their first trip or legalized before 1987, to estimate the effect of first occupation on unauthorized and legalized immigrants' status after 1987. The marginal effect of first occupational wage on later legalization is negative and significant. A 10 percent increase in the occupational wage of the first main job decrease the probability of subsequent legalization by 0.12 percentage points for the average unauthorized immigrant. The previous section revealed that agricultural immigrants tend to stand lower on the occupational wage status, but legalize more.

Indeed, first occupation in agriculture is positively related to legal status after 1987.

Table 3.6: Legalization and first occupational wage

Dependent variable = Legal status in PY				
	(1)	(2)	(1)	(2)
(log) Occupational median wage for first job	0.124**	-0.320***	-0.095	-0.125
	(0.055)	(0.100)	(0.194)	(0.229)
First occupation in agriculture	0.249***	0.115	-0.023	
	(0.045)	(0.071)	(0.115)	
Education in years	0.110***	0.051**	0.031	0.055
	(0.012)	(0.025)	(0.041)	(0.059)
Education squared	-0.004***	-0.001	-0.000	-0.002
	(0.001)	(0.002)	(0.003)	(0.004)
Age/10	0.143	-0.115	0.411	0.289
	(0.097)	(0.165)	(0.294)	(0.458)
Age/10 squared	0.037***	0.013	-0.035	-0.007
	(0.012)	(0.022)	(0.038)	(0.059)
Married during PY	0.219***	0.185***	0.200*	0.210
	(0.032)	(0.067)	(0.105)	(0.132)
Children	-0.087***	-0.021	-0.020	-0.012
	(0.008)	(0.016)	(0.025)	(0.037)
Marginal effect of occupational wage, at mean	0.043**	-0.013***	-0.029	-0.033
Observations	17458	10802	1814	1255
Pseudo R^2	0.438	0.240	0.212	0.248

Standard errors clustered within community-year are in parentheses. *$p < 0.1$, **$p < 0.05$, *** $p < 0.01$.
Note: Dependent variable is an indicator for legal status. The models are estimates using probit regression. Sample characteristics are in the columns headings. Occupational median wage for first job shows the occupational median wage for the immigrant's first main occupation. Column (1) shows the results for the full sample of immigrants, excluding those without occupational information on their first trip. Column (2) excludes immigrants who were legal throughout observation. Column (3) and (4) takes takes only the legalized sample and column (4) excludes those with first occupation in agriculture. Marginal effects are evaluated at the means. All regressions include duration dependence dummies for the first 9 years of experience in the US, separate dummies for year, community and work states in the US and a constant.

Admittedly, the estimation of the legalization model (2) may suffer from its own endogeneity due to an omitted variable that is related to both legalization and the occupational choice in the U.S. For instance, if unauthorized immigrants leave Mexico with the intention to have a shorter trip compared to their legal counterparts, and the intention affects their legal status as well as their first main occupation, indeed the estimates reported in Table 3.6 are biased. Thus, I account for this possibility by analyzing only the sample of immigrants who were

legalized during the observation period. The result, tabulated in Column (3) of Table 3.6, shows that the coefficient of the first occupation is negative but is not significantly different from 0. This result does not appear to be related to those in agriculture, as the results based on the sample of immigrants who worked in jobs other than agriculture on their first trip, are not different. Thus, eventual legalization does not appear to be significantly related to an immigrant's initial occupational outcome. In turn, this result shows that the estimate of the effect of legal status on occupation-based wages does not suffer from endogeneity arising from reverse causality due to earlier labor market outcomes.

Another potential reason for endogeneity arises when an immigrant legalizes due to the legalization of another family member during their trip. A close family member's receipt of legal documentation would tend to lead to legalization as well as better labor market outcomes for the immigrant. Thus, the effect of legal status estimated by omitting this change would be upward biased. I use the information provided by the household heads on their parents' immigration background and information gained from their spouses and children, to provide a descriptive analysis of the immediate household members legalization history for unauthorized immigrant household heads.

Table 3.7: Migratory experience of unauthorized immigrants' families

Family member:	Migrant	Legal		
When legalized:		overall	during obs. unauth.	during obs. legalized
Subsample (of unauthorized and legalized):				
	(1)	(2)	(3)	(4)
Mother[1]	6.8	3.4	0.6	0.8
Father[1]	18.2	4.5	0.6	2.0
Spouse	25.5	7.2	1.1	4.1
Children	19.0	3.9	0.3	0.4
Mother, father, spouse or child[1]	33.2	14.1	2.0	8.5

[1]Among 1523 immigrants surveyed in 1997 and after.
Note: All numbers are in percentages. Total sample size of unauthorized and legalized immigrants is 2220. Legal documentation status of parents are available for 1523 unauthorized and legalized immigrants surveyed in years 1997 and later. Spouse information is available for 2064 unauthorized and legalized immigrants surveyed after the year 1991. Column (3) shows the extent of legalization in the family members of immigrants who are unauthorized throughout the observation period. Column (4) shows the extent of legalization in the family members prior to legalization of those immigrants who start as unauthorized but legalize during the observation period.

Table 3.7 presents the migration experience of the direct family members of the household heads. I consider only those who legalize while the household head immigrant has the unauthorized immigrant status, as legalization after the household head's legalization is not a cause of endogeneity. Consequently, the household head sample in Table 3.7 includes only unauthorized immigrants, both those who legalize during the observation period and those who don't. It appears that migration experience is quite common in their families: 33.2 percent of household heads have at least one other family member with a migration experience to the U.S. and 14.1 percent have a family member with legal status at some point. Although migration experience is common among immigrant families, the frequency of those who legalize during the household head's unauthorized stay is relatively little. Spouses appear to legalize most frequently before the household head's legalization, compared to parents or children. During the observation period, 8.5 percent of families had at least one legalization either before or at the same time as the household head. These would be a cause of endogeneity.

I analyze the sensitivity of the estimates to the presence of time-varying change in the family background of immigrants, by dropping from the sample those unauthorized and legalized immigrants whose direct family member legalized during the observation period, prior to their own legalization. The results from the fixed effects estimation of model (1) are shown in Table 3.8. Since detailed information on the migration history of spouse are available from the surveys of 1991, I use only the sample surveyed after 1991. The results show that indeed the estimates of the effect of legal status are upward biased. After dropping those with a legalized family member, the estimates are smaller, but the signs and the significance levels do not change.

TABLE 3.8: ENDOGENEITY DUE TO THE LEGALIZATION OF FAMILY MEMBERS

Dependent variable = (log) Occupational median wage						
	All surveyed after 1991			Excluding imm. w. legalized family		
	(1)	(2)	(3)	(4)	(5)	(6)
Legal	0.043***	0.013	0.003	0.032***	0.007	0.009
	(0.010)	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)
Legal * Linear trend		0.039***			0.036***	
		(0.008)			(0.007)	
Legal * First trip after 1985			0.081***			0.048***
			(0.018)			(0.018)
Observations	20071	20071	20071	19443	19443	19443
R^2	0.064	0.066	0.066	0.060	0.062	0.061

Standard errors clustered within community-year are in parentheses. $*p < 0.1, **p < 0.05, ***p < 0.01$
Note: Control variables included are age, marital status, number of children in person-year and experience in the US in addition to year, community and US state dummies. Constant included.

3.4.5 Returnees and Stayers

The difference of the MMP sample from samples obtained in the U.S. lies in capturing more temporary immigrants (Hanson, 2006). When returnees' and stayers' experiences of legal status are different, the estimated effect of legality can differ based on the share of returnees and stayers. This section analyzes how the return behavior is related with the legal status and the change in occupational status.

While the number of individuals in the dataset is 3153, as reported above, there are 7356 separate trips due to multiple trips taken by immigrants. Table 3.9 reports

the characteristics of the trips by trip duration. More than half of the trips consist of 1-year observations and most of these are short trips that have a duration of 1-12 months.[24] Apart from these "short observations", 3043 trips equivalent to 16813 person-years are observed in the data. The average trip duration for these "long" trips are 7.8 years in contrast to the sample average of 3.7 years. While 96 percent of short observations end in return 62 percent of long trips end in return. In terms of person-years, about half of the short observations are in the agricultural occupation, only 13 percent of long trips are in agricultural occupations. For short observations, the occupational median wage in a person-year, is 19 percent less than that of longer trips. In terms of the number of individuals, the 4313 short observations are based on 1324 individuals. The data on longer trips are based on that of 2044 individuals. Individuals who take short-trips all have at least 2 trips to the U.S. as the data is limited to those who have at least 2 person-years in the data. More than twice the share of "short observation" individuals are "agricultural immigrants" compared to those who have longer trips. The average number of trips for the "short observation" individuals is also twice the average number of trips that an individual with longer trips take. The legalization ratio is slightly higher for individuals with short-observations. Thus, it appears that individuals who take short trips of 12 or less months in the U.S. are circular or seasonal immigrants who work overwhelmingly in agriculture and earn less than the average immigrant.

[24]Note that observation periods consist of 1987-2014. Thus, part of a trip that started before 1987 but continued to at least 1987 does appear in the sample. The starting year is known for all trips. Thus, while trips are observed for varying lengths of time, trip duration does measure the duration of a trip even if it started before observation.

Table 3.9: Trip characteristics

Observation type:	1-yr observations	> 1yr observation	> 1 yr obs., last trip
Sample size in PY	4313	16,813	13,902
In agriculture, %	47	13	12
Legal, %	55	49	50
Average of occupational median wage, USD	24,211	29,833	30,257
Number of trips	4313	3043	2044
1-year trips, %	97		
Average trip duration		7.8 years	8.8 years
Trip ends in return, %	96	62	53
Number of individuals[1]	1324	2044	2044
Agricultural immigrant[2], %	38	17	
Legalized during obs., %	21	16	
Unauthorized during obs.[3], %	51	54	
Average number of trips	4	2	
Only 1 trip to the US, %	0	63	
Returned from last trip,%	73	50	

[1] An individual might have both short and long trips if the individual has more than 1 trip. [2] Worked in agriculture for at least in one person-year. [3] Unauthorized and did not change status after 1987. Base year of wage is 2010.

To measure the effect of occupational change due to legality on the return behavior, information on the effect of legal status on each individual would be necessary. Unavailability of this information is a reason for the present study. Therefore, in the absence of such data, I measure the effect of occupational standing and legal status on the return rate of immigrants from a trip.

For this analysis, I use a discrete time duration analysis described in the previous subsection. Here, each trip is taken as a unit of analysis and time until return is measured in discrete intervals. The decision to return is viewed now as a set of binary decisions. Each trip is observed for varying lengths of time, depending on when a trip ends in return and whether a trip is censored by the survey or the end of observation. As in the previous subsection, the empirical hazard rate for return is therefore calculated based on the surviving sample at each period of duration.

The empirical hazard rate, or the conditional probability of return from a trip at duration s conditional on not returning until duration s (and other conditioning

variables), is modeled as follows.

$$P(S_j = s|S_j >= s, y_{jt}, D_{jt}, X^r_{jt}) = P(R_{jt} = 1|S_i >= s, y_{jt}, D_{jt}, X^r_{jt}) = G(\xi^r_s, y_{jt}, D_{jt}, X^r_{jt}) \tag{3.3}$$

Here, the individual-trip subscript was simplified to j. S_j is the duration of trip j (at year t) measured in years and G signifies the functional form of the probability. The dependent variable is an indicator for return from a trip in year t. The main independent variables of interest are (log) occupational wage y and the legal status D of an immigrant in year t. Duration indicator ξ^r_s is a dummy variable for duration s. As before, duration dependence is flexibly specified for the first 10 years of a trip and is assumed to be constant after 10 years. Control variables include an indicator for work in agriculture, age, marital status, number of children and education. Year dummies, community dummies, and work state dummies are included as well.

Since legalization and occupations are the results of individual choices, the problem of the omitted variable can again be important here. For instance, return intention at the outset of a trip is an unobserved variable that can influence eventual legal status, the return behavior and the occupational trajectory of immigrants. Due to the potential importance of endogeneity arising from unobserved heterogeneity, preliminary estimates were made using random effects and fixed effects estimations. Comparison between the results using the Hausman test indicates that the results are significantly different from each other. This outcome rules out non-linear methods of analysis that assume independence of unobserved heterogeneity from observed covariates. Due to the high proportion of trips that does not end in return, I proceed to use the fixed effects estimation method for a linear probability model. For this reason, the sample is reduced to the trips that are of more than 1 year in length.[25]

Table 3.10 presents the parameter estimates for the variable of interest. Panel

[25]Since 97 percent of short trips of 12 months or less end in return, the occupational status is not expected to affect return in this sample after seasonality of work is taken into account. More than half of the short trips are spent in agricultural work. Table 3.16 presents the OLS regression results that include the short observation sample.

A shows the estimates for the sample of all trips of 13 months or more. The estimates from a naive regression in Column (1) indicate that both higher occupational standing and legal status are negatively related to eventual return after taking into account observed differences between immigrants. Comparison of Columns (1) and (2) indicates that the unobserved variable associated with a higher return rate is negatively related to legal status and positively related to occupational wage. Legalization decreases the return probability of an individual by 3.1 percentage points. An increase in the occupational median wage of 10 percent further decreases the return probability by 0.36 percentage points.

Table 3.10: Returnees and stayers

Estmation method	Dependent variable = Return in year PY OLS (1)	FE (2)	FE (3)	FE (4)
Panel A. All trips.				
(Log) Occupational wage	-0.012**	-0.036***		
	(0.006)	(0.009)		
(Log) Occupational wage change * Unauthorized			-0.046***	-0.054***
			(0.014)	(0.014)
(Log) Occupational wage change * Legal			-0.031***	-0.035***
			(0.009)	(0.009)
Occupation in agriculture	0.027***	0.054	0.055	
	(0.010)	(0.035)	(0.035)	
Legal	-0.051***	-0.031**	-0.032**	-0.036***
	(0.006)	(0.012)	(0.013)	(0.012)
Observations	16813	16813	16813	14292
R^2	0.142	0.194	0.194	0.187
Panel B. Last trips only.				
(Log) Occupational wage	-0.009	-0.024***		
	(0.006)	(0.007)		
(Log) Occupational wage change * Unauthorized			-0.035***	-0.042***
			(0.013)	(0.012)
(Log) Occupational wage change * Legal			-0.020***	-0.027***
			(0.008)	(0.007)
Occupation in agriculture	0.027**	0.083**	0.084**	
	(0.011)	(0.034)	(0.035)	
Legal	-0.057***	-0.046***	-0.047***	-0.047***
	(0.006)	(0.010)	(0.011)	(0.011)
Observations	14837	14837	14837	12711
R^2	0.122	0.153	0.153	0.149

Standard errors clustered within community-year are in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Note: Occupational wage change variable measures the change in occupational wage compared to the first occupational wage during the observation period. All regressions include control variables for individual's age, age squared, education, education squared (OLS only), marital status, number of children in the year, separate dummies for each year of duration up to 10 years, year, community and work states in the US and a constant.

To investigate the effect of occupational change in legalized individuals, I interact occupational wage with the legal status in Column (3). Since the interacted variable is highly correlated with the legal status due in part to the correlation between legal status and the level of (log) occupational median wage, I subtract the (log) occupational wage in the first observed year from the current (log) occupational wage and interact with the legal status. The result shows that occupational upgrading in legalized and legal individuals negatively affects the return rate. A

ten percent increase in the median occupational wage in legal and legalized individuals decreases their return probability by 0.3 percentage points. The effect of occupational upgrading in unauthorized immigrants is negative and larger than that for legal immigrants. The coefficients become greater in size when agricultural immigrants are excluded, indicating that agricultural immigrants have indeed systematically different return behavior (Column 4).

In case circular migration affects the return rate, I separately look at the immigrants' last trips in Panel B. The estimated effect of occupational upgrading are smaller for both legal and unauthorized immigrants. On the last observed trip, an increase in the occupational median wage of both unauthorized and legal immigrants by 10 percent is expected to reduce the probability of return by 0.2 percentage points. The effect is slightly larger when agricultural immigrants are excluded.

These results indicate that stayers are those immigrants who benefited more from the legal status in terms of occupational upgrading while returnees are those immigrants who benefit less from the legal status. This is likely to cause a overestimation of the effect of legal status in a sample of stayers. Likewise, it is likely to have caused an underestimation in the effect of legal status in the MMP sample of immigrants due to the oversampling of returnees. However, as the size of the effect on return is small, the expected size of the bias would not be large.

3.5 Job Mobility

In this section, I investigate another effect of legal status - occupational mobility. The effect of legal status on the occupational mobility of immigrants can be established using information on how often a legal immigrant changes jobs in comparison to unauthorized immigrants. I use the following to investigate the effect:

$$m_{it} = \delta^m D_{it} + X_{it}\beta^m + \alpha_i^m + \varepsilon_{it}^m \tag{3.4}$$

where the dependent variable y_{it} indicates whether an immigrant changed his job in year t. Except for the dependent variable, the model is identical to the main model (1).

Table 3.11 shows the results of fixed effects estimation. Column (1), the baseline estimates for the sample of all person-years after 1987, shows that legal status leads to more frequent changes in jobs. An immigrant's probability of changing jobs in a person year increase by 12 percentage points following legalization.

Table 3.11: Legalization and job change

	Dependent variable = Indicator for job change in PY					
Sample:	All PY		Exclude 1st legal PY		Exclude last unauth. PY	
	(1)		(2)		(3)	
Legal	0.118***	(0.015)	0.034***	(0.013)	0.023	(0.015)
Age/10	-0.043*	(0.025)	-0.055**	(0.024)	-0.054**	(0.024)
Age/10 squared	0.008***	(0.003)	0.008***	(0.002)	0.008***	(0.003)
Married during PY	-0.003	(0.009)	0.002	(0.008)	0.003	(0.009)
Children	-0.005	(0.004)	-0.003	(0.004)	-0.004	(0.004)
Experience in US, in decade	-0.164***	(0.020)	-0.127***	(0.020)	-0.126***	(0.020)
Experience squared in US	0.018***	(0.003)	0.012***	(0.003)	0.012***	(0.003)
New trip	0.866***	(0.008)	0.877***	(0.008)	0.881***	(0.008)
Observations	21126		20587		20048	
R^2	0.596		0.618		0.623	

Standard errors clustered within community-year are in parentheses. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Note: All regressions include separate dummies for year, community and work states in the US and a constant.

Since the effect of legal status on job mobility may be overestimated due to the initial job change following legalization, I exclude from the sample data of the first legalized year in legalized immigrants. The result (Column 2) is still significant at 1 percent level, but significantly lower at 3.4 percentage points, showing that indeed job mobility is highest in the immediate aftermath of legalization. Further exclusion of the last year of unauthorized stay for legalized immigrants reduces the estimate down to 2.3 percentage points significant at 13 percent level (Column 3). It appears that preparation or application for legalization reduces job change in unauthorized immigrants. Although insignificant at 10 percent level, the marginally significant estimate of 2.3 percent points to slightly higher job mobility as a result of the legal status. Both age and experience in the U.S. have a

non-linear relationship with job mobility, decreasing with age and experience at first and increasing at older age and longer experience. Marital status and number of children appear to have no effect on the job mobility of immigrants.

3.6 Wage

The MMP dataset does not collect information on the wage level due perhaps to the difficulty in recollection of wages received in the past. Occupational information is arguably more easy to remember compared to wages received. However, the dataset records the wage earned in the first main occupation by an immigrant on their first trip to the U.S. and the wage earned at the last main job in the U.S. Using this information in all individuals with at least 2 trips, I attempt to evaluate the effect of legal status on wages. Information about the labor market outcomes on the first and last trips does not allow an ideal evaluation of the effect of legal status. However, a rough estimate of the effect of legal status can be gained from the analysis. The method used in this section is similar to that employed by Lozano and Sorensen (2011), who also estimated the effect of legal status using the MMP sample of immigrants' reported wages on their first and last trips. Using the sample of non-agricultural male immigrants who first immigrated between the years 1980 and 1984, they estimate that the effect of legalization due to the IRCA was an about 23 percent increase in hourly wages.

To evaluate the effect of legalization, I take the sample of immigrant male household heads with at least 2 trips, either unauthorized or with the LPR status, whose first trip occurred after 1965 and the last trip occurred after 1987. Excluding immigrants who did not report their wages, a sample of 1042 immigrants was obtained. The following model is used:

$$Y_{it} = \delta^w D_{it} + X_{it}^w \beta^w + \alpha_i^w + \varepsilon_{it}^w \tag{3.5}$$

where the dependent variable is (log) real hourly wage, converted to the base year 2010, of an immigrant on their first ($t = 0$) or last ($t = 1$) trip to the U.S. Legal

status D is the legal status immigrants hold at the start of their main job on the trip. The background variables in X'''' include an indicator for the last trip, age at entry, dummies for entry year, community and U.S. destination states. I estimate the parameters using fixed effects analysis.

The results are presented in Table 3.12. The estimates for the sample of household heads indicate an increase of 16 percent in hourly wage from the first to the last trip for individuals legalized between the two trips compared to others who did not change status. The wage level increases by 17 percent between the 2 trips. Excluding agricultural immigrants increases the estimate of effect of legal status to 23 percent, just as it increased the estimated effect on the occupational median wage. This indicates that the effect of legal status on non-agricultural immigrants is greater than on agricultural immigrants.

Table 3.12: Effect of legal status on hourly wage

	Dependent variable = (log) Hourly wage			
	(1)		(2)	
Legal	0.146***	(0.027)	0.203***	(0.036)
Last trip	0.154***	(0.026)	0.138***	(0.030)
Age at entry	0.038	(0.158)	-0.193	(0.142)
Age squared	-0.021**	(0.009)	-0.024**	(0.010)
Observations	2084		1206	
R^2	0.210		0.294	

Note: Standard errors clustered within community-entry year are in parentheses. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Column (2) excludes the sample of immigrants performing agricultural work on their first trip. All regressions include separate dummies for entry year, community and first job states in the US and a constant.

3.7 Discussion

The topic of occupational downgrading that occurs as a result of the unauthorized status has been studied systematically in two other papers. Lozano and Sorensen (2011) study the effect of amnesty on occupational outcomes to find that the IRCA-legalized immigrants experienced significant occupational upgrading. Compared to their study, the estimate of the effect of legal status found in

this analysis is smaller. Since Lozano and Sorensen (2011) uses the Census data for occupational information, the composition of immigrants is different from this study. Based on the stock of immigrants in the U.S., Census would underrepresent returnees, while the dataset in the present study is based on the home country leading to over-representation of returnees. Since those who gained a large increase in their labor market outcomes tended to stay long term in the U.S., the Census data would reveal a higher effect of legal status on the occupational outcomes than the MMP. Previous literature indicates that the legal status premium in the wages of high-skilled immigrants is larger than that for the low-skilled (Orrenius et al., 2012).[26] Since Mexican immigrants tend to have lower education than other immigrants, the estimated effect may be lower than that for all immigrants.

The finding however is different from that of Lofstrom et al. (2013), who studied immigrants obtaining legal status in 2003 to conclude that previously unauthorized, low skilled immigrants did not experience occupational improvement due to their legalization. This might be due to endogeneity issues that were not fully addressed in the paper. The result in this analysis of an ordinary linear regression based on observable heterogeneity in immigrants shows a small effect of legalization. However, the effect increases after addressing individual-specific unobserved heterogeneity. Another reason might be the difference in the analysis samples. As Pan (2012) showed, men might experience greater upgrading in wages compared to women. Therefore a combined sample used by Lofstrom et al. (2013) would show smaller effect than the sample of men that I used. Third, the choice of the occupational wage measure affects the outcome. Lofstrom et al. (2013) used gender specific average occupational wage of foreign-born immigrants, whereas I use wages differentiated by the state of work, but not by gender or the foreign birth status. Since Mexican immigrants tend to concentrate in a few states, state differentiation may reveal a more accurate effect, although wages differentiated by the foreign-born status and gender would further improve the accuracy.

It appears that those immigrants who hail from the left tail of the occupational

[26]Mukhopadhyay (2018) find that the return from legalization in higher educated immigrants is slightly less than that for lower educated.

median wage distribution on their first job were more likely to legalize later. That is, those who benefit most from legalization tend to legalize. The result is similar to the reported tendency among immigrants who have "preexisting constraints to occupational mobility" to choose a name change to americanize their names (Biavaschi et al., 2017). Biavaschi et al. (2017) conclude that those who expect more gains choose to conform to the local norms.

The occupational wage difference between legal and unauthorized immigrants is increasing in the post-IRCA years. This finding complements the result observed by Mukhopadhyay (2018) that the post-IRCA immigrants have experienced 18-26 percent higher wage increase compared to the IRCA immigrants. Mukhopadhyay (2018) attributes the difference to the labor market supply shock experienced after the IRCA and employer sanctions introduced by the IRCA. The positive effect of legalization under the IRCA on labor market outcomes may have been moderated, at least in the short term, by the supply shock of legal immigrants reducing their wages (Mukhopadhyay, 2018). Similarly, Kossoudji and Cobb-Clark (2002) found that the wage benefits of the IRCA legalization were smaller than the overall wage penalty experienced by unauthorized immigrants. It may also be due to the fact that the IRCA legalized mostly long term immigrants, who would already have a better occupational position than recently arrived immigrants.

3.8 Conclusion

The objective of this paper has been to measure the causal effect of legality on the occupational outcomes of Mexican immigrant men in the U.S. Mexico is the largest source country of U.S. immigrants. The estimate is indicative of many immigrants' experience in the U.S., as Mexican immigrants represent more than one quarter of all immigrants in the U.S. About half of them are unauthorized immigrants, who also constitute about half of all unauthorized immigrants in the U.S. Using information on the life history of Mexican immigrants, the analysis has uncovered within-individual change in the occupational status that arises from a

change in their legal status occurring in the past three decades. The results show that legal status leads to a better occupational outcome for immigrants and marginally higher job mobility. The effect is increasing in recent years. Naturally, the legal status encourages higher rates of continued stay in the U.S. and those who benefit the most from the legal status tend to stay in greater numbers. Legal status is also associated with significantly higher wages in immigrants.

This study shows that the difference in the outcomes of legal and unauthorized immigrants are not due to the underlying characteristics of individuals but the outcome of the limitations of the unauthorized status. The increasing trend in the effect of legal status on immigrants' labor market outcomes reflects the exponentially increasing enforcement since the IRCA against unauthorized immigrants. It also suggests an increasing asymmetry in the behavior of immigrants - the decreasing reservation wages of unauthorized immigrants in comparison to the legal. The difference needs to be addressed as it can exacerbate discrimination against immigrants and exploitation.

The legal statuses discussed in this study are at the two extremes along a continuum of immigrant status that runs from unauthorized to permanent legal stayer. The findings indicate that immigrants make use of their expanding work opportunity to improve their job match and their income. In between these two extremities lie different mechanisms of legal employment, tried and untried, that can be designed to suit the demand and supply of labor while protecting individuals against unjustifiable treatment. One solution is additional allocation of temporary work permits for foreign workers employed in low skilled jobs.

3.A Appendix

3.A.1. Occupation Details for the Sample

Table 3.13: Detailed, 3-digit occupational groups, %

Detailed occupational group	Mean wage, USD	**Undoc.**	**LPR**
Agricultural workers	20,293	15.0	24.8
Fishery or marine workers	18,608		1.0
Foremen, overseers, and other control persons of agricultural, husbandry or fishery activities	38,889		1.3
Other supervisors including those in unspecified industry	56,218		1.4
Food, beverage and tobacco production, skilled workers, including cooks	22,614	9.9	3.1
Textile and leather production workers	38,314	2.6	2.0
Wood and paper production or printing workers	33,926	1.7	
Metal production and treatment workers, vehicle, machinery, and equipment repair	39,602	2.5	5.2
Construction, installation, maintenance, and finishing workers	43,114	9.8	5.5
Other craftsment or manufacturing workers	23,809	4.4	4.2
Other operators of heavy machinery and equipment	44,684		1.2
Food, beverage and tobacco production unskilled workers	20,423	2.4	1.3
Construction, unskilled workers	31,487	6.3	2.6
Other unskilled workers	23,480	8.3	13.1
Industrial vehicle operators/drivers	25,504		1.2
Truck drivers and land-transport drivers	34,728		1.1
Other conductors, drivers, pilots	23,723	1.0	
Merchants in retail establishments, retail business owners and owners of small business	126,524		1.6
Workers in retail establishments	28,509	3.1	2.0
Sales agents or representatives, brokers, insurance and real estate agents, auctioneers	62,278		1.1
Innkeepers, bartenders, waiters, flight attendants	19,675	8.6	5.8
Doormen, concierges, elevator operators, bellboys, cleaning workers, gardeners, dishwashers	22,494	13.4	6.7
Other personal services worker, eg. parking lot attendants	19,818		1.2
All other occupations		11.0	12.6

Note: Table shows detailed occupational groups with at least 1% representation within unauthorized/legal immigrants, by person-year. Mean wage shows the mean of the occupational (median) wages across the sample. Base year for the wage is 2010.

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3.A.2. Analysis including 1-year observations that were dropped from the main sample

Table 3.14: Trip characteristics

Observation type:	1-yr obs Not in sample	1-yr obs.	> 1yr obs.
Sample size in PY	820	4313	16,813
In agriculture, %	28	47	13
Legal, %	12	55	49
Average of occupational median wage, USD	25,601	24,211	29,833
Number of trips	820	4313	3043
1-year trips, %	90	97	
Average trip duration	1.5 years		7.8 years
Trip ends in return, %	89	96	62
Number of individuals[1]	820	1324	2044
Agricultural immigrant[2], %	28	38	17
Legalized during obs., %		21	16
Unauthorized during obs.[3], %		51	54
Average number of trips	2	4	2
Only 1 trip to the US, %	59	0	63
Returned from last trip,%	89	73	50
Avg. occup. wage for first occup in US, USD	24,566	23,453	25,650
Avg. occup. wage for first occup in US, unauth. and legalized	24,771	23,959	25,830

This table shows a comparison of characteristics for the sample of 820 observations/individuals who were dropped from the main dataset to individuals with multiple, but short trips to the US and individuals with at least 1 longer trip to the US. Short trip is a trip of 12 months or less.
[1] An individual might have both short and long trips if the individual has more than 1 trip. [2] Worked in agriculture for at least in one person-year. [3] Unauthorized and did not change status after 1987. Base year of wage is 2010.

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Table 3.15: Occupation-based wage OLS regression including single period observations

Dependent variable = (log) Occupational median wage	(1)
Legal	0.015**
	(0.006)
Age/10	0.077***
	(0.015)
Age/10 squared	-0.012***
	(0.002)
Education in years	0.001
	(0.002)
Education squared	0.001***
	(0.000)
Married during PY	0.038***
	(0.006)
Children: Total living	-0.006***
	(0.001)
Experience in US, in decade	0.031***
	(0.012)
Experience squared in US	0.009**
	(0.004)
New trip	-0.030***
	(0.005)
Observations	21946
R^2	0.222

Standard errors clustered within community-year are in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Note: This table shows OLS regression results that include 820 individuals with at most 1 period stay in the US. The regression includes year, community, and work state dummies and a constant.

3.A.3. Analysis including 1-year trips that were dropped from the sample in Section 4.5

Table 3.16: Returnees and stayers: OLS regression including single period observations

	(1) All trips	(2) Last trips
(log) Occupational wage	-0.015**	-0.009
	(0.007)	(0.006)
Occupation in agriculture	0.108***	0.027**
	(0.010)	(0.011)
Legal	-0.033***	-0.057***
	(0.007)	(0.006)
Education in years	0.004	0.003*
	(0.002)	(0.002)
Education squared	-0.000***	-0.000**
	(0.000)	(0.000)
Age/10	0.125***	0.017
	(0.018)	(0.016)
Age/10 squared	-0.014***	-0.001
	(0.002)	(0.002)
Married during PY	0.002	-0.003
	(0.007)	(0.006)
Children	0.001	-0.000
	(0.002)	(0.002)
Observations	21126	14837
R^2	0.356	0.122

Standard errors clustered within community-year are in parentheses. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Note: This table shows OLS regression results of the return analysis that include short trips to the US. The regression includes a constant, dummies for duration of trip, and year, community, work state dummies.

Chapter 4

Immigration Policy and the Selection of Immigrants[1]

4.1 Introduction

As of 2015, an estimated 11 million undocumented immigrants lived and worked in the U.S. (Passel and Cohn, 2016). At its highest level, the number of unauthorized immigrants there stood at 12.2 million in 2007. In 2015, unauthorized immigrants constituted 3.5 percent of the U.S. population and 26 percent of the total foreign-born population (Passel and Cohn, 2016). Increasing concerns about unauthorized immigration are fueling political debates and prompting contentious policy measures against immigrants.

Similar statistics exist in other parts of the world indicating the widespread influence of unauthorized immigration worldwide. Such immigrants are variously labeled "illegal," "undocumented," or "unauthorized," terms that have a connotation of their subjects being uninvited and undesirable to the host country. Why, then, is there such a sizable population of them? In the words of Coutin (2003), "illegal immigration has long been officially prohibited but unofficially tolerated."

[1]Joint with Jan Boone.

If we accept that as true, why are unauthorized immigrants tolerated in such great numbers? Can governments do anything to actually reduce their numbers? These questions motivated our analysis.

This paper contributes to the analysis of U.S. policy on undocumented immigration and the literature that explores the strategic value of under-enforcement. We propose a mechanism that indicates that a trade-off exists between the goals of legal versus unauthorized immigration policies. Our proposed model of an immigration system begins with the assumption that the host country's objective is to maximize its welfare in the admission of immigrants, yet in the presence of information asymmetry. Immigrants hold private information with respect to their ability and wish to immigrate to the host country for economic gain. Meanwhile, faced with imperfect screening systems and the objective of selecting high-ability immigrants, a host government uses a system of immigration rules to separate immigrant types.

Prospective immigrants obviously vary greatly in terms of the characteristics that determine their value to employers in the host country; for instance, in their abilities or levels of productivity. Meanwhile, the skill composition of incoming immigrants is an important determinant in how they affect a local labor market.[2] Immigrants also vary in their assimilability to the host culture, a set of characteristics which includes country-specific investment and immigrants' involvement in crime. Immigrants who integrate well and invest in learning the language and culture of the host country are more valuable due to their higher productivity and the lack of assistance required from the host.

When different types of immigrants value immigration options differently, one effective screening tool for the host country is to impose different costs and benefits of immigration on immigrants. This is, in fact, what the different entry conditions to a country entail. A combination of rights attached to entry documentation determines its value to an immigrant. The difficulty of obtaining entry and the enforcement level of immigration law in the host country determine the costs of

[2]For an overview of the research in this area, see Peri (2016) and Dustmann et al. (2016).

immigration for the prospective migrant. We thus view the combination of these tools as a contract in a mechanism design problem.[3]

The result of our model is that when immigrants hold relevant private information, there is a rationale for increasing admission of unauthorized immigrants by curtailing enforcement. This helps create the conditions for distinguishing between less desirable immigrants and more desirable ones (e.g., high-ability) and preventing the former group from permanently immigrating by mimicking the latter.

Our model suggests a mechanism through which a policy aimed at reducing undocumented (low-skilled) immigrants increases low-skilled legal immigration. This effect is not necessarily anticipated (nor desired) by the host country. In a country like the U.S., for example, it can create a bottleneck because of the strict policies for legal immigration in place, which are aimed recruiting high-quality workers, as we document below. The tightening of policies against unauthorized immigration leads to an increase in applications from low-skilled workers for legal entry, cluttering up the costly legal immigration process. Furthermore, it leads to more errors in the process as more low-skilled immigrants are legally allowed to enter the country.

Lastly, our model suggests how the policies on legal and unauthorized immigrants could be aligned to form an integrated immigration policy. When viewed as part of a coherent strategy, the policy on unauthorized immigration is a form of "contract" that can be used to improve the legal immigration outcome.

We show empirically that increasing enforcement measures on unauthorized immigration has repercussions on the outcome of legal immigration policy. In particular, we show that the skill selection of legal immigrants responds to the policy on undocumented immigrants. We present evidence that an increase in border enforcement is followed by a decrease in the average income level of entering legal immigrants for a period of about 5 years. We interpret this as a substitution effect arising from low-skilled immigrants switching from unauthorized to legal

[3]The solution of a mechanism design problem lies in finding the best set of rules for a strategic game with hidden information and multiple agents (Borgers et al., 2015).

entry. When enforcement increases, potential unauthorized immigrants respond by turning to legal immigration.

The remainder of this paper is structured as follows. The rest of this section presents a literature review on the topic of this study. Section 2 presents our model of immigration policy. Section 3 leads the reader to our empirical analysis by giving a brief overview of U.S. immigration policy in terms of legal and unauthorized immigration. The subsequent section introduces the data from our empirical analysis and gives a descriptive analysis. Section 5 presents our set up for the empirical analysis and estimation results, which is followed by a discussion and conclusion in Section 6.

4.1.1 The Economics of the Policy on Unauthorized Immigration

Although the presence of large numbers of unauthorized immigrants could be viewed simply as a failure of law enforcement, economists argue that it is a result of various strategic choices made by policymakers in a host country. Hanson (2006) points out that a government implicitly determines the number of undocumented immigrants in its country through a combination of choices concerning the levels of law enforcement both at the border and in the interior of the country.

What reasons might a host country have for choosing to accept explicitly unauthorized immigration? One might be that, the admission of undocumented immigrants can be a cost-effective way of augmenting the labor force (either temporarily or more long term), since legal immigrants are entitled to public benefits upon entry and to rights of legal procedure for deportation (Hanson, 2009; Cox and Posner, 2007). To illustrate, one of the crucial characteristics of unauthorized laborers is their flexibility in responding to labor market conditions, with their numbers rising when an economy is expanding and shrinking when it is in recession (Hanson, 2009). By contrast, legal immigration quotas rarely change, and the supply of such labor is inelastic, mainly due to the long periods required for

obtaining the necessary visas and the excess demand for visas.

Martin (2014) and Hanson (2006) argue that lenient enforcement may reflect political pressure from powerful firms that benefit from the labor of undocumented migrants. Producers in high-immigrant industries, such as agriculture, textiles, apparel, construction, and services, are the direct beneficiaries of the surplus that undocumented immigrants create. In the past, the U.S. government has faced fierce opposition from businesses, farmers, and industry associations when it has attempted to increase enforcement.

In developing countries, unauthorized immigrants may be tolerated for political rather than economic reasons. A study about Filipino migrants to Malaysia shows that they can vote using documents and citizenship obtained fraudulently (Sadiq, 2005).

One strand of research, to which our study belongs, focuses on the asymmetry of information between immigrants and their host country. Stark (2007) suggests that under-enforcement may be a strategic choice made by governments to secure greater effort on the part of migrants in their work. Using a model of a migrant's decision problem, he shows that a lower expected wage in the origin country compared to the host country can act as a penalty that induces the unauthorized immigrant to exert greater effort than a legal immigrant, who is not likely to be deported. Thus, policymakers can obtain a higher labor effort at a lower cost when migration status is used effectively.

In turn, Cox and Posner (2007) propose that the potential removal of an alien constitutes a method of ex-post screening. Screening potential immigrants for permanent residency rights constitutes an ex-ante screening method, since once they become legal, they are entitled to stay. By contrast, tolerance of undocumented immigration is an ex-post method, since unauthorized immigrants enter the country with little or no screening, and it is less expensive to remove unauthorized individuals than it is to remove legal migrants. They argue that ex-ante screening of high-skilled immigrants is relatively accurate, since such persons are able to provide tangible evidence of their skills such as education records. That

form of screening is thus best suited to highly skilled immigrants, while being less reliable for low-skilled immigrants due to the unavailability of tangible evidence of the required abilities. Accordingly, ex-post screening is more optimal for the latter type of immigrants.[4]

A related line of research analyzes the optimality of amnesty for unauthorized immigrants. Casarico et al. (2018) propose that amnesty balances the fiscal costs arising from welfare benefits to legalized immigrants and the value that is generated by improved job matches in the labor market. They contend that unauthorized immigration limits the job opportunities available to immigrants which leads to overqualified or underqualified workers and a loss in output. Karlson and Katz (2003) argue that access to legalization attracts high-ability immigrants more than low-ability immigrants. That is, potential legalization is a selection mechanism.

Other papers analyzing selection effects include the following. Lozano and Lopez (2013) found that, when undocumented border crossing becomes harder due to enforcement, the selection of unauthorized immigrants changes. They found that female border crossers were more sensitive to the increased cost of immigration than men and that, as a result, the distribution of unauthorized female entrants to the U.S. became more concentrated around younger, low-skilled immigrants in the wake of increased enforcement. By contrast, Orrenius and Zavodny (2005) found that enforcement increases the average education level of incoming unauthorized Mexican men. Bertoli et al. (2016) argue that an explicitly selective immigration policy, such as a point-system, can produce unanticipated results. An immigration policy aimed at increasing the share of highly educated immigrants can result in a decrease in the unobserved quality of immigrants. An increase in immigration among highly skilled workers, leads to a fall in wages among educated immigrants and makes immigration less attractive for high-quality workers since they have better outside options. Other papers have found that explicitly selective immigration policies – such as the point systems used in some countries outside the

[4]The difference between our proposed model and Cox and Posner's (CP) model is that CP model assumes that types are unobservable for some part of the immigrant population only. Thus, unskilled immigration is a selection system for this population. Our model assumes that the types are unobservable for the whole population of (potential) immigrants.

U.S. – do not affect the selection of immigrants, as measured by labor market outcomes (Antecol et al., 2003; Aydemir, 2011; Belot and Hatton, 2012; Jasso and Rosenzweig, 2009).

4.2 A Model of Immigration Policy

This section presents a simple model of an immigration policy aimed at selecting highly skilled immigrants when skill levels are not (easily) observable. We use the terms "ability," and "skill level" interchangeably to refer to the unobservable heterogeneity in productivity among individuals who may have the same observable characteristics. An immigrant's schooling or education level is often observable at the time of immigration and is positively correlated with ability, but the immigrant's eventual productivity is not observable to the host country. Our model focuses on this residual productivity that is unverifiable before immigration.

Our model highlights the trade-off between the goals of enforcement policy and legal immigration policy. While added enforcement against unauthorized immigration aims to reduce unauthorized entry, it channels the efforts of some low-skilled immigrants toward attempting legal entry. Since the skill levels of immigrants are not fully observable, some of the low-skilled immigrants who were dissuaded from unauthorized immigration will successfully enter the host country legally. Since some countries, including the U.S., set quotas for immigration, the share of high-skilled immigrants among legal entries would be reduced. In other words, while boosting enforcement might discourage some individuals from immigrating altogether, for others it just changes the incentive structure so that they migrate using another type of documentation. This can interfere with the immigrant selection goal in the legal immigration route.

We use a principal-agent model to represent the interaction between the host country's immigration policy and immigrant behavior. To highlight the trade-off between different policy goals, we abstract away from the external conditions that affect the supply and demand for foreign labor and assume that these remain

unchanged. Examples of such external conditions are the economic conditions in the host and home countries, including the wage levels for unauthorized and legal immigrant labor in the host country. Practically, this assumption means that (1) the pool of potential immigrants remains constant and (2) conditions other than the immigration policy variables that affect the incentives to immigrate and the net benefits of immigration to the host country remain constant. We start with our representation of immigrants preferences, followed by a model of the host country's immigration policy objectives.

There are two types of immigrant labor being supplied: high-skilled (h) and low-skilled (l). The utility for an h-type legal immigrant is given by

$$u^h = \rho - \gamma \tag{4.1}$$

where $\rho > 0$ denotes the rights given to a legal immigrant and $\gamma > 0$ denotes the costs of legal immigration. Examples of rights ρ are the duration of a work permit, ability to change employers, and social support in the event of unemployment. Examples of the costs of legal immigration γ are the fee for a work permit, the length of approval period, and language and sponsorship conditions for eligibility. The l-immigrant derives utility $u^l > 0$ from working in the host country. We assume that u^l has a distribution $F(\cdot)$ and density $f(\cdot)$.

The host country's preference is to attract a high number of h-type immigrants and few to no l-type immigrants. We assume that h-immigrants are always in demand in the host country, but that the type is unobservable. The country intends to admit h-immigrants under legal immigration permits.

All potential immigrants not admitted legally have the option of unauthorized immigration. It is assumed that this option is attractive only for low-skilled immigrants, since high-skilled individuals have better outside options than unauthorized immigration. The host country can invest in x to reduce the undocumented l-immigrant's utility to

$$u^l - x \tag{4.2}$$

where $x > 0$ represents the cost of unauthorized entry, whereby x is equivalent to the total (enforcement) costs spent by the host country to keep out unauthorized entrants. Examples of such costs are expenditure on border walls and enforcement against unauthorized immigrants including border patrol, immigrant detention and deportation. We normalize the value of potential low-skilled immigrants' outside option (of not immigrating to the host country) at 0. Hence, all types with utility $u^l - x \geq 0$ will try to enter the host country.

4.2.1 Immigrant Behavior

Because an immigrant's skill level is not observable, an l-immigrant can mimic an h-type and enter the host country legally. For instance, when legal immigration is based on family ties, the l-type can attempt to find a partner to sponsor him or her. Alternatively, he or she can attempt employment based immigration by arranging a job that qualifies as an h-type job. An l-immigrant mimicking an h-type acquires utility equal to

$$\hat{u}^l = (1 - \theta)\rho - \gamma \tag{4.3}$$

with θ distributed on $[0, 1]$, with distribution $G(\cdot)$ and density $g(\cdot)$. If an l-immigrant has $\theta = 0$, he or she values rights ρ as much as an h-type. Someone with $\theta = 1$ does not value rights at all. For instance, he or she wants to do seasonal work and return home quickly. For this type of immigrant, the utility of immigrating with a legal status is equal to $-\gamma$. This immigrant does not value permanent residency.

An l-immigrant immigrates as l-immigrant (ie. unauthorized) if the following two conditions are satisfied:

$$u^l - x \geq 0 \tag{4.4}$$

$$u^l - x \geq u^h - \theta\rho \tag{4.5}$$

That is, unauthorized immigration is preferable in utility both to not immigrating and to immigrating by mimicking the h-type.

An l-type immigrates legally by mimicking the h-type if the following conditions are satisfied:

$$u^h - \theta\rho \geq 0 \tag{4.6}$$

$$u^h - \theta\rho \geq u^l - x \tag{4.7}$$

That is, mimicking an h-type is preferable both to not immigrating and to immigrating as an l-type.

Let N denote the share within potential l-immigrants of those who immigrate without authorization and M the share of l-immigrants who enter as an h-immigrant.[5] Assuming that u^l and θ are independently distributed, we find that

$$N = (1 - F(x))(1 - G(u^h/\rho)) + \int_0^{u^h/\rho} \int_{u^h-\theta\rho+x}^{\infty} f(u^l)g(\theta)du^l d\theta \tag{4.8}$$

$$M = F(x)G(u^h/\rho) + \int_0^{u^h/\rho} \int_x^{u^h-\theta\rho+x} f(u^l)g(\theta)du^l d\theta \tag{4.9}$$

The share of unauthorized entrants (out of all possible low-skilled entrants) is equal to the sum of the share of those for whom only unauthorized entry surpasses in utility the outside option of staying and the share of those for whom both types of entry are better than the outside option and unauthorized entry is better in utility than legal entry. Similarly, the share of legal entrants equals the share of those for whom only legal entry is preferable to staying in addition to those for whom staying has the lowest utility and legal entry is preferable to unauthorized immigration. Taken together, the share of l-immigrants who enter the host country is the sum of the shares of those for whom unauthorized entry is preferable than

[5]Derivation of equations can be found in Appendix 4.A.

staying and those for whom only legal entry is preferable to staying:

$$N + M = 1 - F(x) + F(x)G(u^h/\rho) \tag{4.10}$$

4.2.2 Immigration Policy

We define welfare in the country hosting l-immigrants as follows

$$W = V(N) - x - c(M) \tag{4.11}$$

where x represents the total (enforcement) costs of keeping out unauthorized immigrants. The value of having l-immigrants is given by $V(N)$, with $V(0) = 0, V'(0) > 0$, and $V''(N) < 0$. At low entry of l-immigrants, the general value function $V(N)$ is increasing. This represents the positive marginal net value of labor provided by the immigrants at competitive wages. The value function is decreasing at its right end to indicate that, when immigration is too high, marginal net value of immigrant labor is negative. We assume that the host country either has not set a quota for low-skilled legal entrants or that the quota are filled. Thus, legal low-skilled entry M is associated with costs equal to $c(M)$. This represents the costs associated with l-immigrants mimicking h-types. These costs include the extra costs of sorting out the h-applications and expected additional spending on welfare programs for legal immigrants. If the mimicking applicant does enter, it is a low-skilled worker. We assume that $c(0) = 0, c'(M) > 0, c''(M) > 0$.

We also assume that there is a fixed value for $u^h > 0$ that the host country wants to implement so as to be attractive for h-immigrants. The host country aims to remain competitive in attracting high-skilled workers on the global market as a reduction in u^h would lead to a big fall in the high-skilled inflow.[6] Alternatively, the host country has decided that immigrants joining their family members in the U.S. should get a utility equivalent to u^h.

[6]One way to model this is the following. Assume that the outside option for high-skilled immigrants is distributed as $K(\cdot)$. Then, the share of high-skilled immigrants who choose to immigrate to the host country is $K(u^h)$. The distribution $K(\cdot)$ is such that the supply of high-skilled immigrants is infinitely elastic with $K(z) = 0$ for $z < u^h$ and $K(z) = K$ for $z \geq u^h$.

In other words, we ignore the impact of low-skilled immigration on how hospitable the host country aims to be towards h-immigrants. However, for a given u^h, the host country can vary the extent of rights ρ and immigration costs γ to be relatively more attractive to h-types than l-types. Consequently, the policy variables in our model are the legal immigrants' rights ρ and the expenses x for preventing unauthorized immigration.

4.2.3 Immigrant Selection

We now analyze the effect of a change in the policy variables x and ρ on the share of unauthorized and legal l-immigrants. For ease of exposition, we focus on the case where u^l and θ are uniformly distributed with densities of $f(u^l) = b$ and $g(\theta) = 1$, respectively.[7] The first derivatives and the signs of the shares of unauthorized and legal immigration of l-type immigrants are as follows:

$$N_x = -b \qquad N_x < 0 \tag{4.12}$$

$$M_x = \frac{bu^h}{\rho} \qquad M_x > 0 \tag{4.13}$$

$$N_\rho = \frac{b}{2}\left(\frac{u^h}{\rho}\right)^2 \qquad N_\rho > 0 \tag{4.14}$$

$$M_\rho = -\frac{bxu^h}{\rho^2} - \frac{b}{2}\left(\frac{u^h}{\rho}\right)^2 \qquad M_\rho < 0 \tag{4.15}$$

The number of l-immigrants coming as low-skilled worker to the host country falls with x. The more the host country invests to keep l-immigrants out, the fewer come. However, increasing x does make it more attractive for l-immigrants to enter the host country pretending to be h-types.

Increasing rights ρ (and costs γ to keep u^h constant) makes mimicking h-types less attractive for l-immigrants, because the additional rights they gain are valued less than the increased cost of legal immigration. They value rights less than h-immigrants do. Hence, M falls with ρ. As mimicking becomes less attractive,

[7] Derivation of the results under general density distributions $F(\cdot)$ and $G(\cdot)$ is presented in Appendix 4.A.2.

more l-immigrants enter as l-types: N increases with ρ.

4.2.4 Optimal Immigration Policy

We can now determine the optimal values of the policy instruments x and ρ. The first order condition for enforcement x can be written as

$$V'(N)N_x = 1 + c'(M)M_x \tag{4.16}$$

The equation shows that, because keeping unauthorized immigrants out is costly, there will be $V'(N) < 0$ in equilibrium. Thus, there is an undesirable amount of unauthorized immigration with respect to their marginal value at the optimal value of enforcement. If enforcement was costless, the marginal value of an immigrant at the optimal value of enforcement would be equal to zero: $V'(N) = 0$. However, first, the optimal value of enforcement is lower due to its direct cost. Second, the optimal enforcement must be further lowered to take into account the indirect costs of enforcement ($c'(M)M_x$) – the additional costs of l-immigrants entering as h-types. The second type of cost leads us to conclude that there will be an under-enforcement of undocumented immigration beyond the level indicated by the direct marginal cost of enforcement.

The first order condition for rights ρ can be written as

$$V'(N)N_\rho = c'(M)M_\rho \tag{4.17}$$

When the rights for h-immigrants are increased together with the cost of legal immigration, it reduces the attractiveness of mimicking for l-immigrants, thereby reducing M which tends to increase welfare. However, more l-immigrants choose to enter the country unauthorized which reduces welfare. The optimal level of rights balances these two effects.

4.2.5 Policy Implications

Using the second-order conditions at the optimal value of rights ρ and enforcement x, we can describe how one policy variable must optimally respond when another policy variable is changed. Such an approach would bring different parts of the immigration policy into a coherent set with a common objective.

For instance, in the current environment of increasing enforcement against unauthorized immigrants what changes should follow in the policy on legal immigration to counter the negative effect on the selection of immigrants? Let SOC_ρ denote the second order condition of optimal value of rights ρ^* with respect to ρ (ie. the implicit differentiation of (4.17) with respect to ρ. Since we are maximizing welfare $W(\cdot)$, at the optimal ρ^* it must be the case that $SOC_\rho < 0$. We can write

$$-SOC_\rho \frac{\partial \rho^*}{\partial x} = V''(N)N_x N_\rho + V'(N)N_{\rho x} - c''(M)M_x M_\rho - c'(M)M_{\rho x} \quad (4.18)$$

From the expressions above, we see that $N_{\rho x} = 0$ and $M_{x\rho} = -\dfrac{bu^h}{\rho^2} < 0$. Hence, we find that

$$-SOC_\rho \frac{\partial \rho^*}{\partial x} > 0 \quad (4.19)$$

Hence, $\frac{\partial \rho^*}{\partial x} > 0$. This indicates that, in the case of increased enforcement against unauthorized immigration, the rights and costs for legal immigration should also be increased to reduce the incentive for l-immigrants to substitute legal immigration for unauthorized. In other words, the attractiveness of legal immigration should be decreased for low-skilled immigrants while not affecting that of the high-skilled immigrants.

Another policy that is frequently discussed is amnesty for unauthorized immigrants. In 1986, the U.S. legalized about 2.7 million unauthorized immigrants, who made up more than half of the unauthorized population at that time. According to our model, what is the effect of that on legal immigration, and should other policy components change in response?

The legalization component of the 1986 law (IRCA) was aimed at unauthorized immigrants who were already settled in the U.S. Thus, it did not affect potential immigrants directly. However, if it is considered to have created the expectation of another amnesty in the future, it would affect potential immigrants. Some economists have reasoned that this expectation might have contributed to the increased inflow of unauthorized immigration in the years following IRCA (Orrenius and Zavodny, 2003; Hollifield et al., 2014). Thus, by allowing unauthorized immigrants to become legal residents, the law increased the attractiveness of unauthorized immigration. This is equivalent to a decrease in enforcement (x) in our model. The effect is that unauthorized entry (N_x) increases and the legal entry of low-skilled immigrants (M_x) decreases. As a result, the average productivity of legal immigrants would increase due to low-skilled immigrants who switch to unauthorized immigration. If that is the desired effect, no other policy changes are necessary. However, if the increase in unauthorized entry is to be reversed, other components of the enforcement (x) should increase so as not to make unauthorized entry attractive. That is what the IRCA did, by increasing border enforcement and introducing employer sanctions on hiring undocumented workers.

4.2.6 Key predictions

In this section, we sum up the key predictions of our model and suggest ways to test these predictions. In making the predictions, we assume that conditions other than the policy variables that affect the demand and supply of immigrant labor remain stable. If such conditions, for instance the wage level of undocumented immigrant labor or the wage level of legal immigrant labor changes, the optimal values of immigration policy variables are expected to change. However, the underlying trade-off between the choice of legal and undocumented immigration is predicted to remain.

Our model makes three key predictions. First, the difficulty in determining the productivity of immigrants prior to immigration combined with unattractive alternative options to immigration for low-skilled immigrants means that some low-

skilled individuals attempt immigration via the legal or the unauthorized route. The relative attractiveness of these routes depend on the costs and benefits of immigration. Thus, by increasing the costs and benefits of legal and/or undocumented immigration, the host country can affect the immigration choices of low-skilled immigrants. A direct test for this statement is to refer to the behavior of immigrants. For instance, an increase in the number of applications for legal entry following an increase in enforcement would be a test. Other variables that indicate an increased desire to legally immigrate would be increase in temporary entries via employment or study and marriages of foreign nationals with natives. Alternatively, a change in the attempts at legal entry following a change in the benefits and costs of legal immigration would test the prediction.

The first set of predictions leads to the second set of predictions related to the policy variables and the selection of legal immigrants. For instance, increasing the rights and the costs for legal immigration, while keeping the attractiveness of legal immigration to high-productivity individuals unchanged, makes legal immigration relatively less attractive to low-skilled immigrants who do not sufficiently value the rights of permanent entry. While this may lead some low-skilled individuals to refrain from immigration altogether, some attempt undocumented immigration instead. As long as exogenous conditions remain constant, the decreased legal entry of low-skilled immigrants increases the average quality of legal immigrants. Similarly, an increase in enforcement makes undocumented immigration less attractive and legal immigration relatively attractive. Thus, some low-skilled immigrants turn to the legal route decreasing the average quality of legal immigrants. We test the prediction of how immigration enforcement affects the selection of legal immigrants in the remainder of this paper. With an appropriate dataset on the rights and costs of legal immigration, we can further test the effect of the policy on legal immigration on the selection of legal immigrants.

Third, the host country is limited in its ability to reduce undocumented immigration not only by the costs of enforcement but also the costs stemming from the channeling of low-skilled immigrants to the legal route. It burdens the legal immigration system by directly increasing the cost of screening. It also affects the

legal immigration system indirectly by reducing the quality of legal immigrants. For these reasons, the number of undocumented immigrants is predicted to be more than what the direct cost of enforcement would indicate. As the prediction depends crucially on the additional cost of admitting low-skilled immigrants legally, a test of this prediction may look into the effect of an exogenous change in the costs of admitting legal immigrants on the policy variables. Examples of a change in the costs of admitting legal immigrants are the changes in the public benefits for legal immigrants and improvements in the screening of immigrants.

We document below one of the key predictions. Namely, that the substitution effect leads to an increased entry of low-skilled legal immigrants when enforcement is increased. In response to increased enforcement, some low-skilled immigrants enter the country as legal immigrants. This is observed in the lower quality of legal immigrants. We first summarize the institutional background and the data that we used.

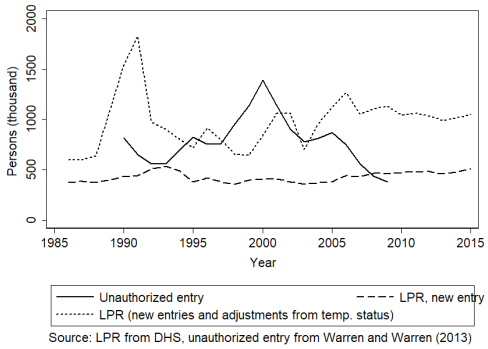
4.3 Institutional Background

This section begins our empirical analysis of the U.S. immigration policy. Specifically, we show how enforcement against unauthorized immigration reduces the average skill level of legal immigrants; thereby interfering with the goals of legal immigration policy. In this section we present the background to our empirical analysis by characterizing some specifics of U.S. immigration policy and its emphasis on highly skilled immigrants.

Until recently, the U.S. had seen a steady increase in the number of immigrant arrivals from 1.7 million in the 5-year period from 1965 to 1970 to 7.6 million between 1995 and 2000. The number fell slightly, to 6.0 million, in the 5-year span from 2008 to 2013. These numbers include naturalized citizens, legal permanent immigrants and legal temporary immigrants such as students and employees. Legal permanent immigrants and unauthorized immigrants make up a considerable share of immigrant arrivals. Since 1990, the entry of legal permanent immigrants

has remained stable, at around 500,000 per year, while the number of unauthorized immigrants entering the country is estimated to have peaked in 2000 at 1,4 million per year (Figure 4.1) (U.S. Department of Homeland Security, 2017b; Warren and Warren, 2013). The number of immigrants who receive legal permanent residency (LPR) status, which includes those immigrants who adjusted to LPR while on a temporary stay in the U.S., has exceeded 1.0 million per year since 2005.

FIGURE 4.1: IMMIGRANT ENTRY AND ADJUSTMENT



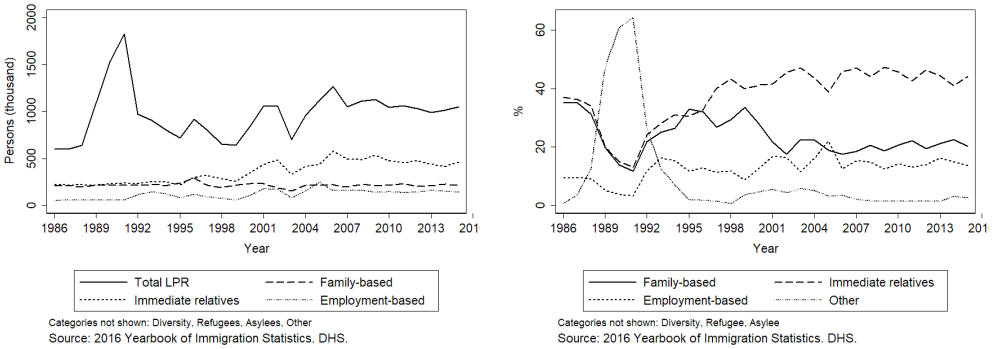
4.3.1 Policy on Legal Immigration

With the exception of a large-scale amnesty program in 1986, that legalized some 2.7 million unauthorized immigrants in the short period between 1990-1992, there has been a steady increase in the allocation of permanent residency status to immigrants over the decades, from about 400,000 per year in the 1970-s to slightly more than 1.0 million per year from 2005 onward (Figure 4.1). The basis for quota system currently in place for immigrant admissions was established with the Immigration and Nationality Act (INA) of 1965, also known as Hart-Celler, which gave preference, first, to family members of U.S. citizens and permanent resident aliens and, second, to skilled labor. It established an annual quota for the admission of legal immigrants and excluded the admission of immediate relatives of U.S. citizens from that quota.[8] The quota was lowered slightly in 1980, from 290,000 to 270,000, but increased again to 675,000 in 1990. It has remained at that level

[8]The quota for admission includes those who adjust from a temporary non-immigrant status.

ever since.[9] Given that the admission of quota-based immigrants has remained unchanged over the years, the bulk of the recent increase in LPR admissions can be attributed to higher admissions of immediate relatives of U.S. citizens and slight increases in the admission of employment-based legal immigrants (Figure 4.2(a)).

FIGURE 4.2: LPR COMPOSITION IN NUMBERS AND SHARES



(a) Total LPR allocation in number

(b) Shares in total LPR

The basic underlying principle of the U.S. policy is that immigrants should be self-sufficient.[10] Built on this principle, then, the current quota system admits people based on their family or employer ties (Figure 4.2). It aims to admit immigrants who can "rely on their own capabilities and the resources of their families, their sponsors, and private organizations."[11] The law sets an annual quota for family-based and employment-based immigrants.[12] Combined, it allows for up to 675,000 quota-based immigrants per year, as mentioned above.

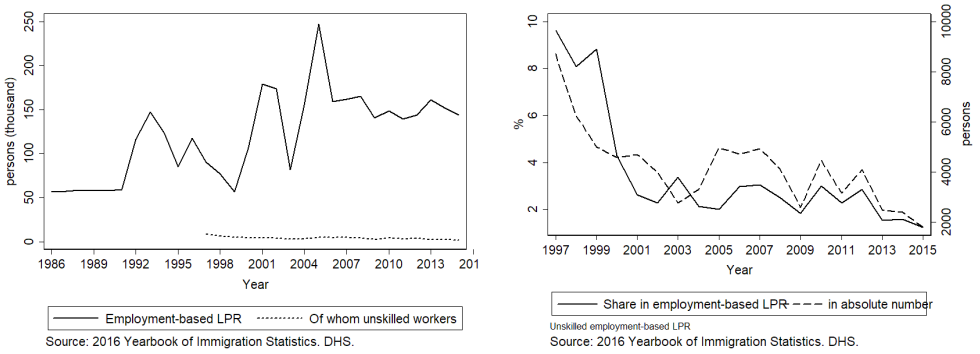
In addition, immediate relatives of U.S. citizens are admitted outside of the quota. Thus, altogether the U.S. has accepted about 1.0 million new LPR immigrants in every year of the 21st century. A majority of them are immigrants joining their family members in the U.S.

The second largest category is that of employment based immigrants. Although the U.S. did admit employment-based immigrants prior to 1990, it did not es-

[9]Except for a reduction by 15,000 of family-based immigrants between 1992-1994.
[10]USC 8, 1601.
[11]Section 1601, USC 8, 1601.
[12]It also admits 55,000 diversity based immigrants, allocation of which is based on lottery.

tablish an explicit quota for this category until 1990. As a result, employment based immigration increased from less than 60,000 prior to the law to 120,000 in 1992, the year of its inception. The legally permitted number of 140,000 has not changed since. Under the total cap, flexible quotas are established as guidelines for admitting skilled migrants. The quota of 140,000 for employment-based immigrants includes priority workers and persons of extraordinary ability in the arts, sciences, business, or sports sectors (40,000), workers with advanced degrees (40,000), skilled workers (40,000) with at least a 2-year certificate or college degree, including up to 10,000 "unskilled labor" and specialty workers and investors (up to 20,000). In fact, far fewer than 10,000 "unskilled immigrants" are admitted as permanent immigrants in any given year (Figure 4.3). Thus, the policy of employment-based immigration is aimed at admitting highly skilled workers.

FIGURE 4.3: UNSKILLED EMPLOYMENT-BASED IMMIGRANTS



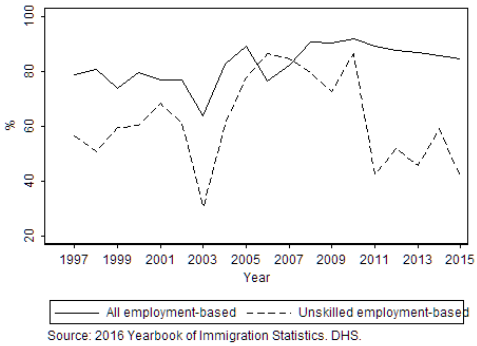
(a) Total allocation of employment based LPR

(b) Share of unskilled in employment-based LPR allocation

In every year since 1997, more than eight out of ten legal immigrants in the employment based category received their permits through an adjustment of their status (Figure 4.4). This applies to situations in which the migrant worker previously arrived in the U.S. either on a temporary employment permit or as a family member someone with such a permit. Students are not allowed to adjust their status to an employment-based permanent permit. The adjustment rate among unskilled employment-based immigrants is considerably lower than that of the group as a whole. Thus, it appears that the admission of (highly skilled) employment-based legal immigrants occurs through two stages of selection: (1) the initial selection

of foreign temporary workers (through employer sponsorship criteria) and (2) the self-selection of foreign temporary workers into permanent immigration.

FIGURE 4.4: SHARE OF STATUS ADJUSMENTS IN EMPLOYMENT-BASED LPR ALLOCATION



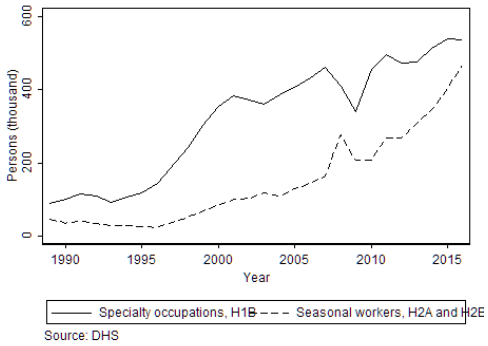
A corollary to the self-sufficiency principle is that immigrants must not rely on public benefits available to U.S. citizens. Thus, the law puts various limits on the availability of public benefits to most legal immigrants. It also requires that a sponsor, such as a family member, be financially responsible for the immigrant and that the sponsor have sufficient income to do so. Since low-skilled individuals are at greater risk of poverty and unemployment, these restrictions are aimed at further reducing the incentives for low-skilled individuals to immigrate.

Thus, although the U.S. does not explicitly base their immigration criteria on skills (as with a point-system employed in some countries), the employment- and family-sponsorship based immigration combined with limited welfare creates an indirectly selective immigration system. Indeed, a previous study indicates that the outcome of the U.S. immigration policy and an explicitly skill-selective immigration policy is identical after accounting for heterogeneity in source countries (Antecol et al., 2003).

4.3.2 Policy on Foreign Temporary Workers

The main types of workers admissible for temporary employment are highly skilled workers and seasonal workers, both of whom require petitioning by an employer.

FIGURE 4.5: MAJOR CLASSES OF TEMPORARY WORKER ADMISSION



As of 2016, 42 percent of temporary worker entries, excluding spouses and NAFTA professionals, were employed in specialty occupations (USDHS, 2017).[13] This category of entry is also known as the H1-B visa. The visa is awarded to workers in certain high-skilled sectors who are sponsored by their employer; it is available to people with a university-level education. Another 36 percent of applicants awarded temporary status were seasonal workers, both agricultural and non-agricultural (Figure 4.5).[14]

Whereas seasonal workers are not allowed to stay in the U.S. for more than 3 years total, high-skilled immigrants are given an opportunity for possible permanent immigration. Although their work permit expires after 6 years, temporary workers who fall under this category are allowed to apply for an employment based permit after 5 years of entry. Furthermore, H1-B visa itself can be extended until the individual obtains a lawful permanent resident card. Thus, the U.S. policy on temporary immigration is part of a policy for promoting the immigration of highly skilled individuals.

[13]North American Free Trade Agreement professionals are Mexican and Canadian citizens employed in a profession specified by the agreement. With some exceptions, all of the listed occupations require a university degree. About 816,000 NAFTA professional entries to the U.S. were recorded in 2016.

[14]Another 19 percent of entrants were performing artists and athletes and those with extraordinary achievement in given fields.

4.3.3 Policy on Unauthorized Immigration

While the emphasis of the legal immigration policy is on admitting highly skilled immigrants, the U.S. policy on unauthorized immigration focuses on preventing and controlling it. The enactment of the Hart-Celler Act (INA) in 1965, upon the expiry of a 20-year seasonal contract worker program between the U.S. and Mexico, marked the beginning of the inflow of unauthorized migrants, which continued to grow steadily into the 21st century.

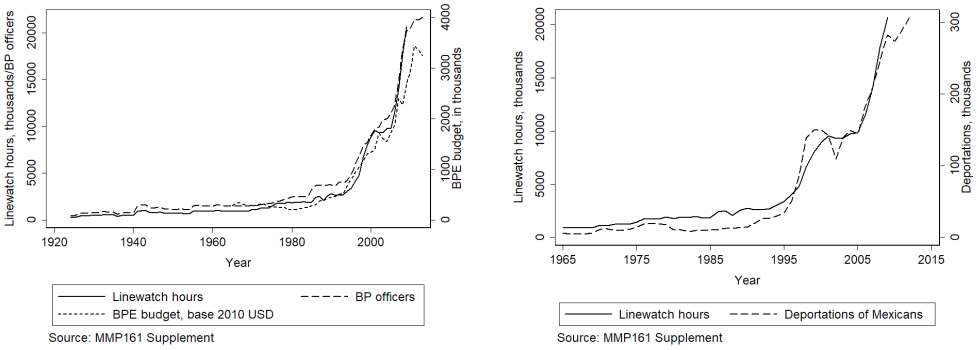
Various measures were taken over the ensuing four decades in an attempt to deal with this influx. In 1986, a major immigration reform was implemented, which granted legal status to the majority of undocumented immigrants at the time, increased border control staff by 50 percent, and mandated employer verification of immigrant workers' status.[15] Border control and internal enforcement against unauthorized immigrants were further strengthened in 1990 and 1994.[16] In 1996, a major legal reform targeting unauthorized immigrants was implemented that covered all aspects of enforcement.[17] It increased border security and penalties for unauthorized entry and stay and provided for enhanced internal enforcement. Together with the welfare reform enacted that same year, it prevented unauthorized immigrants from having access to public benefits and social security benefits.[18] They were similarly denied driver's licenses.[19] Further increases in border enforcement followed in 2005 and 2006.[20] Some states started to require mandatory online verification by employers of new workers' employment status in 2007.[21]

The trend in U.S. immigration policy as detailed above indicates that enforcement against unauthorized immigration has steadily increased since the 1990's (Figure 4.6). This affects the behavior of potential immigrants attempting unauthorized entry. For instance, they might change their points of entry from heavily enforced

[15]Immigration Reform and Control Act.
[16]Immigration Act of 1990, Violent Crime Control and Law Enforcement Act of 1994, Operation Gatekeeper of 1994.
[17]Illegal Immigration Reform and Immigrant Responsibility Act.
[18]Personal Responsibility and Work Opportunity Reconciliation Act of 1996.
[19]The program was piloted in 1996 and became law in 2005 with the Real ID Act.
[20]Secure Border Initiative, Operation Streamline; Secure Fence Act; Operation Jump Start.
[21]Legal Arizona Workers Act of 2007.

posts to less guarded, rural locations (Gathmann, 2008). They might also switch their strategy to one of attempting legal entry, as we will show in the sections below.

FIGURE 4.6: ENFORCEMENT AGAINST UNAUTHORIZED IMMIGRATION



4.4 Data and Descriptive Analysis

Based on the theoretical predictions, our empirical analysis seeks to verify the connection between increased enforcement of undocumented immigration and immigrants attempting legal immigration. Ideally, this would call for analyzing the data from applications for legal immigration. However, no data on visa applications is currently available. Although summary information on the allocation of legal immigration permits is available, we are not aware of any data on LPR or other visa issuance that contains detailed information on the characteristics of the recipients over the years. Thus, we chose to analyze data on immigrants in the U.S. to infer how the skill levels of the incoming legal immigrants relates to the level of enforcement in the year of their entry.

We use data from the Survey of Income and Program Participation (SIPP), a longitudinal survey conducted by the U.S. Census Bureau. As part of the survey, a nationally representative sample of adults in the U.S. are periodically interviewed to record data on individual and household monthly income and participation in government programs. Each panel runs for about 4 years. During that time, each individual in the dataset is interviewed once a quarter to collect monthly

information for the previous four months. When one panel is completed, the next one starts. We use individual-level datasets from the 1996, 2001, 2004, and 2008 panels as our main dataset. We include the latest panel, from 2014, for robustness analysis only, since we are unable to identify some legal entrants in this panel due to a lack of information on the immigrants' adjustment status. In each case, we use the sample containing adult immigrants (aged 15 and above) who had moved to the U.S. in the preceding 6-20 years.[22] We further restricted this to immigrants who were at least 12 and no older than 64 years of age at entry, thereby excluding those who were too young to have made an independent decision about immigrating and older people, who are less likely to have entered for work.

The advantage of SIPP over other types of nationally representative large surveys, such as the census or the American Community Survey, is that it contains information on the immigration status of the respondents, along with other detailed data on income, work, and education history. In the sample of immigrants, we can identify whether they are citizens, were admitted to the U.S. as a permanent resident, or adjusted their status to permanent residency after entry. Therefore, while we are not able to directly verify whether an immigrant entered in an unauthorized manner, we can identify unauthorized entrants indirectly as those who are not legal entrants.

We define legal entrants as those foreign-born residents who are citizens, and/or moved to the U.S. as a permanent resident, and/or adjusted to permanent resident status after entering as a temporary legal entrant. The remaining immigrants - those who are not citizens, did not enter as permanent residents, and did not adjust to permanent residency after 5 or more years of stay - are considered "unauthorized" immigrants.

We use the sample of immigrants who had stayed in the U.S. for at least 6 years

[22]Since the return rate of immigrants may differ according to their skill level, the skill distribution of U.S. stayers at any one time will not reflect the skill distribution at entry. To account for this heterogeneity in return, we use the dataset of immigrants entering the U.S. within the same period of time preceding each panel.

by the end of the survey, since any period shorter than that is not long enough for a legal temporary worker to be eligible for permanent residency. Legal temporary residents (e.g., highly skilled workers) are allowed to adjust to permanent residency, whereas unauthorized ones are generally not. The only unauthorized entrants eligible for adjustment are those who are immediate relatives of U.S. citizens and certain special immigrants, such as children without parents to return to. Respondents with an adjusted status, therefore, are likely to be legal (non-permanent) entrants, such as temporary workers. Any shorter duration of stay does not allow for this distinction. In addition, we exclude all immigrants who arrived in or before 1982, so as to prevent having unauthorized immigrants who became legalized as a result of IRCA being considered as legal entrants. Legalized immigrants would have been categorized in the survey either as adjusted to LPR and/or as current citizens and, would thus be mistakenly picked up as legal immigrants in our data.

Lastly, we exclude the sample of immigrants with no work history during the survey, since our measure of migrant productivity is based on information on individual income. About 19 percent of all immigrants reported no employment during the survey. After excluding these immigrants, we have a dataset of 9847 immigrants of whom 19.2 percent were unauthorized. The proportion of unauthorized immigrants in the foreign-born population in SIPP is less than the population share of 27 percent in 2000 and 28 percent in 2010 reported by the Pew Research Center (Passel and Cohn, 2016; Pew Research Center, 2015).[23] This may reflect a shortcoming in our identification procedure, as well as some selection bias in the survey coverage of unauthorized and legal immigrants, since unauthorized immigrants may be apprehensive about being surveyed. Though we use only the legal sample in our empirical analysis, we report the descriptive statistics for both groups for comparison.

[23] http://www.pewhispanic.org/2017/05/03/facts-on-u-s-immigrants-current-data/

Table 4.1: Descriptive statistics for legal and unauthorized immigrants

	Legal	**Unauthorized**
Observations	7947	1894
Education, (as % of total):		
Up to 8 years of education	13.4	26.3
Between 9 and 11 years of education	8.1	13.3
High school graduate	22.3	24.7
Some college experience, no undergraduate degree	24.1	15.7
Undergraduate degree or higher	32.3	20.0
Income:		
Real monthly personal earnings from all jobs if employed, (average for sample)	3070 USD	2209 USD
Real monthly household net income, (average for sample)	5829 USD	4231 USD
Other characteristics		
Female, (as % of total)	47.6	40.1
Married at any point during the survey, (as % of total)	75.8	67.3
Never married, (as % of total)	14.3	24.5
Metropolitan residence, (as % of total)	88.7	88.8
Age, (average for sample)	40	35
Duration in U.S., (average for sample)	13 years	11 years
Age at entry, (average for sample)	29	25
Year of entry to U.S., (range)	1983-2007	1983-2007
Most common countries of origin, (as % of total)		
Mexico	27.8	54.4
India	5.9	3.6
Philippines	5.6	1.2
China	5.0	3.2
Vietnam	3.2	0.4
El Salvador	3.1	5.4
South Korea	2.3	1.1
Russia	2.0	0.3
Guatemala	1.5	3.9
Honduras	1.0	2.2

Notes: Age is the average age of the individual during the survey period, which lasts 3-6 years. Individual's income and household net income are the corresponding medians for the individual during the survey period. Base year for real income is 2010. Metropolitan status of residence is taken as status at the beginning of the survey. Due to the entry year being observed with a 1-4 year range, we use the minimum duration in the U.S. (up to the last year of the survey) as duration of stay, and lowest age at entry for age at entry. Countries of origin were not available for the 2008 panel, and only regions of origin were available for the 2008 and 2014 panels.

Since the surveys cover a range of 3-6 years, we observe each individual for a varying length of time. Longitudinal information on each respondent is transformed to individual-level information. An individual's reported level of education on their last survey is taken as their education level. In the sample, 85 percent of the individuals had not changed their education level during the survey period. The median of the real individual incomes over the survey is taken as the individual's representative level of income. The prices for real income are indexed to 2010.

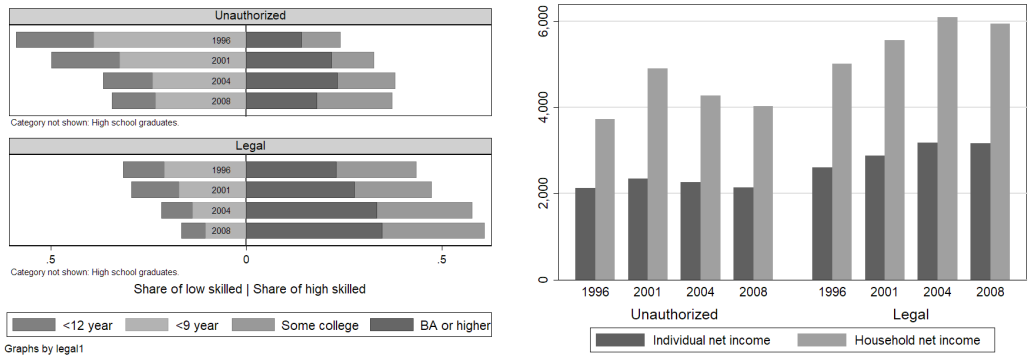
Due to the entry year to the U.S. being observed within a 1-4 year range, we take the minimum duration in the U.S. (up to the last year of survey) as the duration of stay, and the lowest age at entry as the age at entry.[24] For instance, for an individual born in 1970, who entered the U.S. between the years of 1991 and 1993, and was surveyed for the 2004 panel in years 2003-2007, the age at entry is recorded as 21 and the duration of stay in the U.S. is 14 years.

As documented elsewhere (e.g., Caponi and Plesca (2014); Altangerel and van Ours (2017)), the descriptive statistics shown in Table 4.1, indicate that unauthorized and legal immigrants have different levels of education, income, and other characteristics. Legal immigrants have higher level of education than the unauthorized: 22 percent of legal immigrants have less than a high school level of education compared to 40 percent of unauthorized immigrants. Meanwhile, 32 percent of legal immigrants have a college level education or higher compared to 20 percent in the unauthorized category. In other words, unauthorized immigrants have a lower level of observable skills. Incomes for unauthorized immigrants are significantly lower than for legal immigrants. The share of females and married individuals is higher among legal immigrants, while the share of people who have never been married is higher among unauthorized immigrants. The average age of legal and unauthorized immigrants in the dataset is 40 and 35 respectively. The age at immigration is higher for legal immigrants and legal immigrants have slightly longer duration in the U.S. The immigrants in both sample groups entered the U.S. between the years of 1983 and 2007.

We observe a rising trend in the education level of incoming immigrants when looking at each panel survey (Figure 4.7). The share of low-educated respondents fall to a significant degree among both unauthorized and legal immigrants. This is in line with rising education levels in the source countries. Between 1980 and 2010, the share of the population in developing countries with no more than primary education fell by 25 percentage points to 40 percent (Barro and Lee, 2013). In Mexico, the main source country for unauthorized immigrants to the U.S. (see

[24] In all panels except for the panel of 1996, the year of entry is known within a 2 year range. Only in the panel of 1996, the year of entry is known within a 4 year range.

FIGURE 4.7: IMMIGRANTS' SKILL LEVEL IN EACH PANEL, BY LEGAL STATUS



(a) Share of low- and high-skilled immigrants in each panel, by legal status

(b) Average monthly income in each panel, by legal status

Table 4.1), the share fell by 38 percentage points, to 36 percent (Barro and Lee, 2013).[25] The increase in education levels is seen in immigrants of both statuses, but the trend may have reversed in unauthorized immigrants since the survey study of 2004. The increase in skill levels is accompanied by an increase in real individual net incomes and household net incomes for legal immigrants (Figure 4.7 (b)).

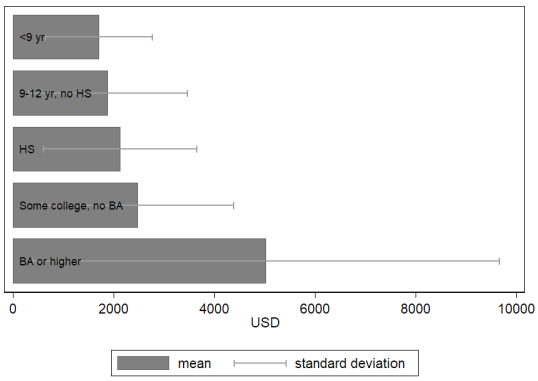
Our theoretical model is based on the assumption of unobservable heterogeneity in immigrants at the time of immigration. We show the variation in legal immigrants' net incomes in Figure 4.8. The graph indicates that there is a considerable variation in the productivity of legal immigrants with similar levels of education.

4.5 Empirical Analysis

Our theoretical model posits that, while some potential immigrants will only immigrate legally, others choose between the legal or unauthorized routes depending on the costs and benefits involved. Since high-skilled individuals are offered more

[25]The Mexican government has put an increasing emphasis on education in recent decades. According to data published by the UNESCO Institute of Statistics, the Mexican government's expenditure on education as a percentage of GDP increased by more than twofold in the 20 years leading up to 2010, reaching 5.2 percent in 2010.

FIGURE 4.8: MEAN OF INDIVIDUAL NET INCOME AND ITS STANDARD DEVIATION, BY EDUCATION AND LEGAL STATUS



opportunities for legal immigration, lower skilled immigrants make up a higher share of the unauthorized segment. Thus, it is the low-skilled immigrants who must frequently choose between legal and unauthorized immigration. The model therefore predicts that, when enforcement against unauthorized immigration is increased, thereby raising its attendant costs, many low-skilled immigrants will attempt to enter legally. This is not desirable for a host country that aims to admit mainly, or even exclusively, high-skilled immigrants, because it strains the legal screening process, resulting in higher costs and more errors. Our conjecture, in sum, is that increased enforcement results in greater legal entry on the part of low-skilled workers, thereby reducing the average productivity of new legal immigrants.

In this section, we examine whether the productivity of incoming legal immigrants is influenced by immigration policy. We focus on the effect of border enforcement against unauthorized immigration, an integral component of immigration policy. The main goal of enforcement at the border is to prevent unauthorized entry by foreign-born persons.[26] It is therefore not usually associated with legal immigration. However, we find that the skill selection of legal immigrants varies according to the levels of border enforcement in place. The pattern of change we discover suggests that substitution between legal and unauthorized immigration is occurring.

[26]https://www.cbp.gov/border-security/along-us-borders

4.5.1 Empirical Model

A standard way of measuring how enforcement affects the selection of immigrants would be to observe the average skill level of immigrant groups in their entry year and relate that observation to enforcement levels in the preceding years. However, to begin with, we lack a measure of the immigrants' skill level before entry and must thus rely on contemporaneous measures of skill level. Second, the time series of entry-year intervals between 1975 and 2007 that were available only gave us a sample of 21 points, which is insufficient for analysis. This limited sample size coupled with the lack of a skill measure prior to immigration ruled out time series analysis. Therefore, using individual-level observations, we proceed to verify how the skill level of legal immigrants relates to border enforcement.

Levels of border enforcement are not expected to affect the skill level of legal immigrants directly. Instead they affect the selection of immigrants through their choice of legal status. Following the literature (e.g., Bertoli et al., 2016), we measure an individual's productivity by their income level. The income level is likely to be affected by events subsequent to immigration, as well as by legal status. Thus, in our regression using the sample of legal immigrants, we control for factors that affect income levels and verify how residual productivity is related to enforcement. We note that the quota for the admission of unskilled legal immigrants has not changed since it was introduced in 1992 (Figure 4.3 (a)). Thus, the increase in legal admissions throughout the 1990's should either be accompanied by an increase in skill level among legal immigrants or, at the very least, not be negatively affected.

To measure the relationship between enforcement and the productivity of immigrants, we estimate the following model:

$$Y_i = \beta_0 + \beta_1 E_i + \gamma X_i + v_i \tag{4.20}$$

where Y_i indicates immigrant i's (log) monthly income. An immigrants' income is taken as the median of his or her monthly incomes during the survey period.

Using the consumer price index reported by the Bureau of Labor Statistics, real incomes were obtained in 2010 USD. E_i indicates the enforcement level prior to the year of the immigrant's entry. Because our data on the entry year is only known to within a 1-4-year interval (with 78 percent of entry years known to within a 1-year interval), we take the earliest year as an individual's immigration year to ensure that the enforcement level is exogenous to entry. We take the annual linewatch hours spent by the border patrol agents controlling the border as a measure of border enforcement intensity.[27] Background variables X_i include age at entry,[28] gender, schooling level, current age,[29] marital status at the beginning of the survey, duration of stay in the U.S., and the metropolitan status of residence at the beginning of the survey. Schooling level is an ordinal variable recorded as an integer in the interval $[31, 46]$, the lowest being "less than first grade" and the highest "Doctorate degree." In addition to individual characteristics, we control for the business cycle effects by including national unemployment level at the time of entry and the state level unemployment measured at the start of the survey. We include an indicator variable for temporary legal entrants during 1999-2003 to control for the effect of increased admission of highly skilled individuals in the wake of the American Competitiveness and Workforce Improvement Act of 1998. This law might have increased the average skill level of legal immigrants entering during that period, which could be confounded with the effect of enforcement if not controlled for. We account for the increase in the admission of legal immigrants, which could affect the average skill level of the incoming cohort, by including a 1-year lagged (log) LPR admissions. Lastly, origin country and U.S. state dummies are included to control for heterogeneity across sending countries and destination states' labor markets for legal immigrants.

[27] As our measure of enforcement varies across the years, a model with year dummies is not identified. We control for a linear (and quadratic, in the robustness tests) trend across the years.

[28] Due to the fact that year of entry is only specified to within a given interval, age at entry is taken at the earliest year of entry. For instance, if an individual's age at entry is reported as 15, the individual was at least 15 years old at entry.

[29] Current age is the average age of the individual over the 3-6-year survey.

4.5.2 Parameter Estimates

To determine the lag with which enforcement affects the selection of immigrants, we first perform regressions using a contemporaneous or a lagged value for the log linewatch hours with respect to immigrants' year of entry (Table 4.2). Estimates using our main sample are provided in Column 1. These indicate that border enforcement indeed affects legal immigrant selection negatively, for up to a 4 year period. After 4 years, the effect diminishes in size and becomes insignificant. The estimates indicate that a 1 percent increase in enforcement is associated with a 0.1 percent drop in the incomes of the incoming legal immigrant cohort for about 1-4 years afterward.

Based on these results, we evaluate our model using a 1-4 year lagged moving average for the linewatch hours variable. We do not include contemporaneous levels of enforcement so as to ensure that changes in enforcement precede immigrant entry. The estimates presented in Column (1) of Table 4.3 indicate that 1 percent increase in the 4-year average of enforcement at the border reduces the incomes of the incoming cohort of legal immigrants by 0.11 percent.

The estimates for the control variables have the expected signs. A higher education level is associated with higher incomes for immigrants. Female immigrants have significantly lower income levels. Despite similar levels of average education, the female immigrants in the data report a monthly net income of 2425 USD versus 3655 USD reported by male immigrants.[30] Legal immigrants' incomes increase with age, peaking at about the age of 36. Marital status is significantly related to education level. Married immigrants and those who are divorced or widowed earn more than the others. Those living in metropolitan areas have higher incomes. The linear trend variable at the time of entry indicates no significant trend in the current (log) income level of incoming immigrants. Economic conditions in U.S. at the time of entry affects immigrant selection. A one percentage point increase in the unemployment level increases the current median income of immigrants by 2 percent. It indicates the low-skilled individuals' immigration plans are more

[30]Mean difference is significant at the 1 percent level.

affected by unemployment level in the U.S. compared to those of the high-skilled. In other words, lower skilled individuals appear to be more likely to delay legal immigration or not immigrate legally if the employment conditions in the U.S. are deteriorating.

Table 4.2: Legal immigrants' income from employment

Dependent variable = (Log) Individual net income						
	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Main	2014	No adj.	> 1985	trend^2	6-25
0-lagged (log) linewatch hours	-0.087	-0.065	-0.045	-0.040	-0.093	-0.087
	(0.067)	(0.064)	(0.062)	(0.077)	(0.089)	(0.066)
1-lagged (log) linewatch hours	-0.093*	-0.072	-0.091*	-0.078	-0.102*	-0.090*
	(0.052)	(0.050)	(0.048)	(0.059)	(0.062)	(0.050)
2-lagged (log) linewatch hours	-0.098**	-0.082*	-0.073*	-0.098*	-0.136**	-0.097**
	(0.048)	(0.045)	(0.042)	(0.056)	(0.066)	(0.047)
3-lagged (log) linewatch hours	-0.086*	-0.074*	-0.072*	-0.083	-0.114*	-0.088*
	(0.048)	(0.045)	(0.044)	(0.051)	(0.067)	(0.048)
4-lagged (log) linewatch hours	-0.085*	-0.084*	-0.062	-0.090*	-0.183*	-0.086*
	(0.048)	(0.045)	(0.045)	(0.053)	(0.090)	(0.048)
5-lagged (log) linewatch hours	-0.046	-0.055	-0.029	-0.043	-0.046	-0.048
	(0.046)	(0.043)	(0.042)	(0.050)	(0.097)	(0.047)
6-lagged (log) linewatch hours	-0.020	-0.044	0.008	-0.033	0.072	-0.020
	(0.054)	(0.050)	(0.043)	(0.057)	(0.112)	(0.054)
7-lagged (log) linewatch hours	0.043	0.004	0.035	0.047	0.237**	0.042
	(0.052)	(0.049)	(0.041)	(0.053)	(0.093)	(0.051)
8-lagged (log) linewatch hours	0.027	-0.004	0.019	0.020	0.124	0.026
	(0.054)	(0.051)	(0.039)	(0.055)	(0.082)	(0.054)
9-lagged (log) linewatch hours	-0.020	-0.035	0.001	-0.051	0.025	-0.021
	(0.062)	(0.060)	(0.042)	(0.066)	(0.087)	(0.062)
10-lagged (log) linewatch hours	0.137	0.061	-0.003	0.139	0.232**	0.135
	(0.096)	(0.091)	(0.052)	(0.096)	(0.111)	(0.094)
Observations	7947	9311	10248	6687	7947	8116

Robust standard errors in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

Note: This table shows the coefficient of the main independent variable in linear regressions with a dependent variable as (log) individual income. Each cell corresponds to one regression, where the main independent variable is the lagged (log) linewatch hours variable. Controls consist of current age, duration of stay, gender, education level, marital status, metropolitan status, indicator for temporary legal entrant during 1999-2003, state level unemployment at the beginning of the survey, 1-period lagged national unemployment at year of entry, 1-period lagged log LPR admission, a linear trend for year of entry, a constant, panel dummies, US state dummies, and origin country dummies. Column (1) features the estimates on the main sample. Column (2) adds the sample of LPR entrants and citizens from the 2014 panel. Column (3) excludes status adjusters, includes 2014 panel and takes all those LPR entrants and citizens who immigrated in the past 1-20 years. Column (4) excludes immigrants arrived before 1986. Column (5) controls for squared trend in addition to linear trend. Column (6) takes the sample of legal immigrants from all panels who arrived 6-25 years prior to the survey.

Table 4.3: Productivity of legal immigrants

Dependent variable = (Log) Individual net income						
	(1)		(2)		(3)	
	Main		2014		No adj	
Moving average linewatch hours	-0.108**	(0.054)	-0.090*	(0.050)	-0.093*	(0.050)
LPR admissions	-0.018	(0.032)	-0.021	(0.031)	-0.029	(0.030)
Temporary legal entry in 1999-2003	0.061	(0.050)	0.059	(0.050)	0.166	(0.131)
Individual characteristics						
Female	-0.457***	(0.016)	-0.447***	(0.016)	-0.444***	(0.015)
Age	0.072***	(0.005)	0.075***	(0.005)	0.073***	(0.005)
Age squared	-0.001***	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)
Education	0.075***	(0.003)	0.079***	(0.003)	0.075***	(0.002)
Marital status						
Married, spouse absent	-0.080*	(0.044)	-0.087**	(0.040)	-0.100***	(0.035)
Widowed	0.030	(0.076)	0.019	(0.072)	-0.042	(0.080)
Divorced	0.029	(0.032)	-0.011	(0.031)	-0.003	(0.030)
Separated	-0.074*	(0.042)	-0.097**	(0.045)	-0.133***	(0.046)
Never married	-0.100***	(0.023)	-0.101***	(0.022)	-0.109***	(0.020)
Metropolitan status of residence						
Non-metropolitan	-0.071**	(0.035)	-0.095**	(0.039)	-0.079**	(0.035)
Trend and return						
Unemployment at time of entry	0.022**	(0.010)	0.019**	(0.010)	0.015*	(0.008)
Unemployment at start of survey	-0.022	(0.013)	-0.010	(0.014)	-0.017	(0.012)
Duration	0.004	(0.008)	0.003	(0.008)	0.001	(0.006)
Linear trend	0.005	(0.009)	0.003	(0.009)	0.001	(0.008)
Observations	7947		9311		10248	
R^2	0.294		0.276		0.272	

Robust standard errors in parentheses. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Note: The dependent variable is (log) individual's net income. Column (1) shows the estimates for the main sample. Column (2) includes the 2014 panel. Column (3) includes the 2014 panel, excludes all adjusted immigrants and adds immigrants who've arrived 1-5 years ago. Moving average linewatch hours refers to (log) moving average of linewatch hours at the Mexico-US border 1-4 years previously. Education level is recorded in 16 categories, the lowest being "less than first grade" and highest "Doctorate degree". Education is measured at the last survey. Excluded category for marital status is "Married, spouse present". A constant, panel dummies, origin country dummies and US state dummies are included in all regressions.

After controlling for individual characteristics that are related to the income level, we observe how the residual skill level is related to exogenous policy factors. In contrast to enforcement against unauthorized immigrants, changes in the LPR admission level do not appear to affect the selection of immigrants. In other words, increased admission of legal immigrants does not disproportionally affect the low-skilled immigrants. Similarly, the increased admission of temporary high-skilled immigrants in 1999-2003 did not affect the pool of legal immigrants. This is perhaps to be expected, as the added quota of 50-130 thousand high-skilled

immigrants was small compared to the annual number of legal admissions.

Taking into account that, the entry years are known within 1-year range for 61 percent of immigrants and, within 1-4-year range for 74 percent, we can conclude that enforcement against unauthorized immigration affects the skill selection of legal immigrants for about 5 years. Our interpretation of this effect is that the low-skilled workers turn to legal immigration in response to increased enforcement. Given that the immigration system doest not distinguish perfectly between high- and low-ability immigrants, many of them immigrate legally to the U.S. in the following few years, reducing the average productivity of incoming immigrants.

4.5.3 Robustness Analysis

We now turn to the robustness analysis of our results. First, we are able to verify the robustness of our results by adding the sample of immigrants from the panel survey of 2014. Although we can not identify temporary legal entrants in the data (from adjustment to permanent status), we can identify those who are now citizens and those who entered with LPR status. We add these immigrants to the main sample, after applying the same criteria as to the main sample, including entry within 6-20 years of the panel survey. The results of the regressions on the expanded sample, in which different lags of the enforcement variable are used, are shown in Column (2) of Table 4.2. The coefficient estimates for the enforcement variables are slightly lower in size but have the same sign and structure as in the main sample. Column (2) of Table 4.3 shows the estimates of the regression with a 4-period moving average of past enforcement. The coefficient of enforcement level is smaller in size, at -0.09 percent, and is significant at the 10 percent level. The control variables are similar to the main estimates as well.

Next we adjust our main sample once more using the panel of 2014, to create a sample of only current citizens and permanent entrants. We exclude all adjustees (who were not yet citizens) from the legal entrant category. Since we can identify current citizens and LPR entrants among all immigrants, including those who

entered 1-5 years previously, we now add this data as well. Our adjusted sample then consists of immigrants who are citizens and/or LPR entrants, who had arrived 0-20 years previously. The coefficient estimates on this sample are shown in Column (3) of Table 4.2. The coefficients of the 0-5 period lagged enforcement variables have the same sign and the first 1-3 lags are significant, but not the fourth. In Column (3) of Table 4.3, we show the regression results with a 4-period moving average of past enforcement. The size of the enforcement effect is again smaller than that of the main result but significant.

To prevent the 1986 IRCA law from affecting our results, we have excluded all immigrants who arrived before 1982. Because the law also legalized unauthorized immigrants who had worked in agriculture for at least 3 years prior to 1986, we might otherwise have picked them up in our data. Thus, we check the robustness of our results by further excluding all immigrants who had arrived prior and up to 1985. The estimates in Column (4) of Table 4.2 indicate that our results hold for immigrants who arrived after the law was enacted, and thus could not have been legalized through IRCA.

Since our estimates might have been sensitive to the form of the trend variable, we also add a squared trend as control. The estimates shown in the Column (5) of Table 4.2 show that our main results are robust to this possibility. The coefficients of the 0-5 lagged enforcement variable so estimated are slightly greater in size and have the same sign and significance level as the main results.

Lastly, to exclude the possibility that our data cutoff choice for immigrants with up to 20-years of residency has influenced the results, we run a sample of immigrants with 6-25 years of stay, including the 2014 panel. In other words, we expand the sample used in Column (2) of Table 4.2. The results, shown in Column (6) show no significant changes in the estimates, especially when compared to the sample results of Column (2).

4.5.4 Gender, Entry Age, and Education Level

In this section, we analyze how personal characteristics at entry influence the effect of enforcement on selection. First, we estimate the effect of gender. Columns (1) and (2) in Table 4.4 show the coefficient of the 4-period moving average of linewatch hours variable from regressions on the male and female immigrant sample respectively. We use the same specification as in the main analysis except for using different samples. The results show that male immigrants' selection is affected by enforcement, whereas female immigrants' selection does not appear to be affected.

This is consistent with the overall characteristics of unauthorized immigrants, who are more likely to be male. Caponi and Plesca (2014) estimate that 44 percent of the unauthorized immigrants in the U.S. are female, compared to 57 percent of legal immigrants. Our own descriptive analysis shows that 40 percent of the unauthorized immigrant sample is female. These samples consist of those immigrants residing in the U.S. If we look at returnees, we observe that an even higher share of unauthorized immigrants are male. In a sample of Mexican unauthorized immigrants consisting of returnees and stayers whose family members were located in Mexico, 76 percent were male (Altangerel and van Ours, 2017). Thus, if unauthorized immigrants turn to legal immigration, this is likely to have a greater effect among male legal immigrants. Another possible reason for female immigrants' selection not being greatly affected by enforcement is a possible difference in unobserved qualities of female versus male immigrants switching to the legal pathway. For instance, if the unobserved productivity of female unauthorized immigrants who switch to legal immigration is similar to that of the legal immigrants, then we would expect not to see any difference in selection. Since our results in Table 4.3 indicate that female legal immigrants earn about 37 percent less than males, it is possible that the income level of female legal immigrants is less affected by those switching from unauthorized immigration. Similarly, if the unobserved abilities of male immigrants are lower than those of legal male immigrants, we would also see the above result.

Table 4.4: Effect of enforcement by individual characteristics

Dependent variable = (Log) Individual net income						
	(1)	(2)	(3)	(4)	(5)	(6)
	Male	Female	Entry $\leq$ 27	Entry$>$ 27	$\leq$HS	$>$HS
Moving average linewatch hours	-0.232***	-0.002	-0.075	-0.096	0.058	-0.193***
	(0.070)	(0.083)	(0.072)	(0.080)	(0.073)	(0.073)
Observations	4168	3779	4179	3768	3472	4475
R^2	0.287	0.219	0.314	0.279	0.195	0.269

Robust standard errors in parentheses. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Note: This table shows the coefficient of the 4-period moving average of (log) linewatch hours variable. Controls consist of current age, squared age, duration of stay, gender, education level, marital status, metropolitan status, indicator for temporary legal entrant during 1999-2003, 1-period lagged log LPR admission, 1-period lagged unemployment level at year of entry, unemployment at start of the panel survey, a linear trend for entry year, a constant, panel dummies, US state dummies, and origin country dummies. Column (1) uses the sample of male immigrants, column (2) female immigrants, column (3) all immigrants who immigrated before the age of 26, column (4) all immigrants who immigrated after the age of 27, column (5) all immigrants with a high school level schooling or lower, and column (6) all immigrants with more than high school level of schooling.

Second, we divide the sample of immigrants roughly in half by their age upon entry. The results of regressions in Columns (3) and (4) using the samples of immigrants age 12-27 and age 28-64 at entry, respectively, show that the effect of enforcement is not different by age category.

Lastly, we look at the effect of education. Roughly half of the sample has at most a high school level of education. The coefficient of the enforcement variable in this sample is close to 0 and statistically insignificant. By contrast, the coefficient for the sample of immigrants who had either some college experience, a bachelor's degree or a graduate degree is negative and significant at the 1 percent level. This could be related to the criteria for legal entry. People with a higher education have a much greater chance of obtaining temporary or permanent residency, since the criteria for employment-based LPR and temporary work permits are based on observable levels of education. As we discussed above, even those who immigrate on a family based LPR permit are more likely to be better educated and more affluent in light of the fact that one of the requirements is that the receiving family member have sufficient funds to sponsor the immigrant. Regardless of the observable level of education among immigrants, it is likely that those switching from unauthorized to legal immigration have lower unobserved abilities than other

legal immigrants. In this case we would expect to see the result shown in Column (6).

4.6 Conclusion

Although no consensus exists as to why there are 11 million undocumented immigrants in the U.S., one prevalent view is that it is a result of a failure in enforcing immigration policy. We provide an alternative explanation, arguing that under-enforcement has a value. In other words, unauthorized immigration stems in part from an immigration policy aimed at admitting highly skilled immigrants. Our paper contributes to the literature that explains under-enforcement as a strategic choice.

In this paper, we present a model of immigration policy and immigrant behavior that helps explain the large presence of unauthorized immigrants in the U.S., as well as the effect of immigration policy on the selection patterns for legal immigrants. In our model, the undocumented status forms part of a policy that aims to distinguish immigrants by unobserved ability.

Our model makes three predictions. First, in our model, the optimal immigration policy leads to too many unauthorized immigrants entering the host country. Namely, the number of undocumented immigrants is predicted to be more than what the direct cost of enforcement would suggest. This is because enforcement has indirect costs, in addition to its direct costs. The indirect costs include the cost of legally admitting low-skilled immigrants. Second, our model predicts that changes in both the undocumented and legal immigration policies affects the number of low-skilled immigrants entering legally and undocumented. This undermines the selection of legal immigrants, the goal of the policy on legal immigration. For instance, immigration enforcement to limit unauthorized immigration affects the number of low-skilled legal entries. Thus, an increase in enforcement reduces the average skill level of incoming legal immigrants due to immigrants switching to legal entry. If unauthorized and legal immigrants come from the same skill dis-

tribution (and the effect of enforcement is the same along the distribution), then immigrants' choice for legal or unauthorized status would not affect the selection of legal immigrants. However, legal immigrants tend to be more highly skilled than unauthorized ones. Therefore, when unauthorized immigrants turn to legal entry, the quality of legal immigration applicants decreases. Third, the latter effect is caused by the observation that the benefits and costs of legal immigration affect potential immigrants' choice of entry route thereby affecting the selection of legal entrants.

We provide evidence for the second prediction, namely that enforcement does indeed affect the skill selection of legal immigrants. While the observed education and income levels of recent legal immigrants are increasing, increased enforcement appears to be reducing the average productivity of legal immigrants. A 1 percent increase in border enforcement is associated with a decrease in the income level of incoming legal immigrants of about 0.11 percent on average. We verify that the fall in the productivity of legal immigrants occurs for up to 5 years after an increase in enforcement. Furthermore, we find that the selection of young, educated, male legal immigrants are more affected by immigration enforcement than that of the other groups.

The terms "undocumented," "illegal," and "unauthorized" all connote the undesirable status of such immigrants. We view immigration status as a form of entry contract, or entry documentation, part of the mechanism that makes up a selective immigration policy. As a form of contract, it can be further studied for its efficiency and usefulness, and its form can be improved to fit the overall goals of that policy. Since the unauthorized status harms immigrants' labor market outcomes (Altangerel, 2018), low-skilled immigrants could be admitted as temporary migrants instead, with attendant costs and benefits that would still serve to distinguish between types of immigrants. Importantly, our analysis shows that the goals of immigration policy as it pertains to unauthorized and legal entrants should be aligned to form a coherent overall policy.

4.A Appendix

4.A.1 Immigrant Behavior

An l-type individual immigrates as an l-immigrant (i.e., unauthorized) if one of the following conditions are satisfied:

$$\begin{cases} u^l - x & \geq 0 \\ u^h - \theta\rho & \leq 0 \end{cases} \tag{4.21}$$

or

$$\begin{cases} u^h - \theta\rho & > 0 \\ u^l - x & \geq u^h - \theta\rho \end{cases} \tag{4.22}$$

That is, l-type immigrants opt for the unauthorized route when they don't value rights enough. Deriving the share N of l-immigrant entries as follows from (4.21) and (4.22):

$$N = (1 - F(x))(1 - G(u^h/\rho)) + \int_0^{u^h/\rho} \int_{u^h - \theta\rho + x}^{\infty} f(u^l)g(\theta)du^l d\theta \tag{4.23}$$

$$= 1 - F(x) + F(x)G(u^h/\rho) - \int_0^{u^h/\rho} F(u^h - \theta\rho + x)g(\theta)d\theta \tag{4.24}$$

An l-type individual immigrates legally by mimicking the h-type if one of the following conditions are satisfied:

$$\begin{cases} u^h - \theta\rho & \geq 0 \\ u^l - x & < 0 \end{cases} \tag{4.25}$$

or

$$\begin{cases} u^l - x & \geq 0 \\ u^h - \theta\rho & \geq u^l - x \end{cases} \tag{4.26}$$

where condition (4.26) is equivalent to:

$$\begin{cases} x \leq u^l \leq u^h - \theta\rho + x \\ u^h - \theta\rho \geq 0 \end{cases} \tag{4.27}$$

That is, l-type immigrants opt for the legal pathway when don't value unauthorized immigration enough. Deriving the share M of legal entries as follows from (4.25) and (4.27):

$$M = F(x)G(u^h/\rho) + \int_0^{u^h/\rho} \int_x^{u^h-\theta\rho+x} f(u^l)g(\theta)du^l d\theta \tag{4.28}$$

$$= \int_0^{u^h/\rho} F(u^h - \theta\rho + x)g(\theta)d\theta \tag{4.29}$$

The share of l-immigrants (out of all possible l-immigrants) that enter the host country is:

$$N + M = 1 - F(x) + F(x)G(u^h/\rho) \tag{4.30}$$

4.A.2 Immigrant Selection

4.A.2.1. Unknown Distributions $F(u^l)$ and $G(\theta)$

The first derivatives of the share of unauthorized l-type immigrants, N, with respect to the policy variables ρ and x under unknown distributions $F(u^l)$ and

$G(\theta)$ are:

$$N_x = -f(x)(1 - G(u^h/\rho)) - \int_0^{u^h/\rho} f(u^h - \theta\rho + x)g(\theta)d\theta \tag{4.31}$$

$$N_\rho = -\frac{u^h}{\rho^2}F(x)g(u^h/\rho)) - \frac{\partial}{\partial\rho}\int_0^{u^h/\rho} F(x + u^h - \theta\rho)g(\theta)d\theta = \tag{4.32}$$

$$= -\frac{u^h}{\rho^2}F(x)g(u^h/\rho)) - (-u^h/\rho^2)\left[F(x + u^h - \theta\rho)g(\theta)\right]_{\theta=u^h/\rho} -$$

$$- \int_0^{u^h/\rho} \frac{\partial}{\partial\rho}\left(F(x + u^h - \theta\rho)g(\theta)\right)d\theta = \tag{4.33}$$

$$= -\frac{u^h}{\rho^2}F(x)g(u^h/\rho)) + \frac{u^h}{\rho^2}\left[F(x)g(u^h/\rho)\right] -$$

$$- \int_0^{u^h/\rho} -\theta\left(f(x + u^h - \theta\rho)g(\theta)\right)d\theta = \tag{4.34}$$

$$= \int_0^{u^h/\rho} \theta f(x + u^h - \theta\rho)g(\theta)d\theta \tag{4.35}$$

The first derivatives of the share of LPR entry of low-skilled immigrants, M, with respect to the policy variables ρ and x under unknown distributions $F(u^l)$ and $G(\theta)$ are:

$$M_x = \int_0^{u^h/\rho} f(u^h - \theta\rho + x)g(\theta)d\theta \tag{4.36}$$

$$M_\rho = (-\frac{u^h}{\rho^2})\left[F(u^h - \theta\rho + x)g(\theta)\right]_{\theta=u^h/\rho} + \int_0^{u^h/\rho} \frac{\partial}{\partial\rho}F(u^h - \theta\rho + x)g(\theta)d\theta = \tag{4.37}$$

$$= -\frac{u^h}{\rho^2}F(x)g(u^h/\rho) - \int_0^{u^h/\rho} \theta f(u^h - \theta\rho + x)g(\theta)d\theta \tag{4.38}$$

The signs of the first derivatives (4.31), (4.35), (4.36) and (4.38) are:

$$N_x < 0 \tag{4.39}$$

$$N_\rho > 0 \tag{4.40}$$

$$M_x > 0 \tag{4.41}$$

$$M_\rho < 0 \tag{4.42}$$

The second derivatives of N are, from (4.31) and (4.35):

$$N_{xx} = -f'(x) + f'(x)G(u^h/\rho) - \int_0^{u^h/\rho} f'(x+u^h-\theta\rho)g(\theta)d\theta \tag{4.43}$$

$$N_{\rho\rho} = -\frac{u^{h2}}{\rho^3}f(x)g(u^h/\rho) - \int_0^{u^h/\rho} \theta^2 f'(x+u^h-\theta\rho)g(\theta)d\theta \tag{4.44}$$

$$N_{x\rho} = \int_0^{u^h/\rho} \theta f'(x+u^h-\theta\rho)g(\theta)d\theta \tag{4.45}$$

The second derivatives of M are, from (4.36) and (4.38):

$$M_{xx} = \int_0^{u^h/\rho} f'(u^h-\theta\rho+x)g(\theta)d\theta \tag{4.46}$$

$$M_{\rho\rho} = 2\frac{u^h}{\rho^3}F(x)g(u^h/\rho) + \frac{u^{h2}}{\rho^4}F(x)g'(u^h/\rho) + \frac{u^{h2}}{\rho^3}f(x)g(u^h/\rho) + \\ + \int_0^{u^h/\rho} \theta^2 f'(u^h-\theta\rho+x)g(\theta)d\theta \tag{4.47}$$

$$M_{x\rho} = -\frac{u^h}{\rho^2}f(x)g(u^h/\rho) - \int_0^{u^h/\rho} \theta f'(u^h-\theta\rho+x)g(\theta)d\theta \tag{4.48}$$

4.A.2.2. Uniform Distributions $F(u^l)$ and $G(\theta)$

The derivatives (4.31), (4.35), (4.36) and (4.38) of N and M w.r.t. x, ρ for the case where u^l and θ are uniformly distributed with densities $f(u^l) = b$ and $g(\theta) = 1$

are as follows:

$$N_x = -b(1-u^h/\rho) - \int_0^{u^h/\rho} bd\theta = -b(1-u^h/\rho) - bu^h/\rho = -b \quad N_x < 0 \tag{4.49}$$

$$M_x = bu^h/\rho \quad M_x > 0 \tag{4.50}$$

$$N_\rho = \int_0^{u^h/\rho} \theta b d\theta = \frac{bu^{h2}}{2\rho^2} \quad N_\rho > 0 \tag{4.51}$$

$$M_\rho = -\frac{u^h}{\rho^2} bx - \int_0^{u^h/\rho} \theta b d\theta = -\frac{bxu^h}{\rho^2} - \frac{bu^{h2}}{2\rho^2} \quad M_\rho < 0 \tag{4.52}$$

The second derivatives and their signs are, using (4.49) - (4.52):

$$N_{xx} = 0 \qquad N_{xx} = 0 \tag{4.53}$$

$$N_{\rho\rho} = -\frac{bu^{h2}}{\rho^3} \qquad N_{\rho\rho} < 0 \tag{4.54}$$

$$N_{x\rho} = 0 \qquad N_{x\rho} = 0 \tag{4.55}$$

$$M_{xx} = 0 \qquad M_{xx} = 0 \tag{4.56}$$

$$M_{\rho\rho} = \frac{2bxu^h}{\rho^3} + \frac{bu^{h2}}{\rho^3} \qquad M_{\rho\rho} > 0 \tag{4.57}$$

$$M_{x\rho} = -bu^h/\rho^2 \qquad M_{x\rho} < 0 \tag{4.58}$$

4.A.3 Optimal Immigration Policy

Host country welfare W is given as:

$$W = V(N) - x - c(M) \tag{4.59}$$

The first order conditions of the host country welfare W with respect to ρ and x are, from (4.59):

$$W_x = V'(N)N_x - 1 - c'(M)M_x = 0 \tag{4.60}$$

$$W_\rho = V'(N)N_\rho - c'(M)M_\rho = 0 \tag{4.61}$$

The second order conditions with respect to ρ and x are, using (4.60) and (4.61):

$$\frac{\partial x^*}{\partial \rho} = -\frac{W_{x\rho}}{W_{xx}} \tag{4.62}$$

$$\frac{\partial \rho^*}{\partial x} = -\frac{W_{\rho x}}{W_{\rho\rho}} \tag{4.63}$$

where

$$W_{xx} = V''(N)N_x^2 + V'(N)N_{xx} - c''(M)M_x^2 - c'(M)M_{xx} \tag{4.64}$$

$$W_{\rho\rho} = V''(N)N_\rho^2 + V'(N)N_{\rho\rho} - c''(M)M_\rho^2 - c'(M)M_{\rho\rho} \tag{4.65}$$

$$W_{x\rho} = V''(N)N_\rho N_x + V'(N)N_{x\rho} - c''(M)M_\rho M_x - c'(M)M_{x\rho} \tag{4.66}$$

The expressions (4.64), (4.65), (4.66) are simplified as follows under the uniform distributions of u^l and x:

$$W_{xx} = V''(N)N_x^2 - c''(M)M_x^2 \qquad W_{xx} < 0 \tag{4.67}$$

$$W_{\rho\rho} = V''(N)N_\rho^2 + V'(N)N_{\rho\rho} - c''(M)M_\rho^2 - c'(M)M_{\rho\rho} \qquad W_{\rho\rho} < 0 \tag{4.68}$$

$$W_{x\rho} = V''(N)N_\rho N_x - c''(M)M_\rho M_x - c'(M)M_{x\rho} \qquad W_{x\rho} > 0 \tag{4.69}$$

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